KANSAS CITY

REVIEW OF SCIENCE AND INDUSTRY,

A MONTHLY RECORD OF PROGRESS IN

SCIENCE, MECHANIC ARTS AND LITERATURE.

VOL. III. DECEMBER, 1879. NO. 8.

GEOGRAPHY.

INTERNATIONAL POLAR STATIONS.

CAPT. H. W. HOWGATE, U. S. A.

The International Geographical Congress which convened in Hamburg in October, met for the purpose of securing harmonious action on the part of the governments and geographical societies of Europe and America in the work of Arctic exploration. Delegates were present from Germany, the Netherlands, Russia, France, Austria, Denmark, Sweden and Norway. England and the United States were not represented, but both are expected to coöperate in the plans of the Congress.

As a result of the deliberations of the Congress, a resolution was adopted recommending the establishment of permanent stations of observation in the Arctic regions at the following named places, and to be under the direction of the countries specified: First station, Eastern Greenland, to be maintained by Germany; second station, Jan Mayen, to be maintained by Holland; third station, Finnmarken, to be maintained by Norway; fourth station, North Spitzbergen, to be maintained by Sweden; fifth station, North Novaya Zemblya, to be maintained by Austria; sixth station, at the mouth of the Lena River, to be maintained by Russia; seventh station, *Lady Franklin Bay*, and eighth station, Point Barrow, both to be maintained by the United States; ninth station, Upernavik, in Western Greenland, to be maintained by Denmark.

It will be seen that foreign geographers appreciate the claims of the United

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States to the northern portion of this continent, and assign them the lion's share of work, with a corresponding share of the honors to be achieved by a successful prosecution of the enterprise

The selection of Lady Franklin Bay as the location of the most northern of the stations is an endorsement of the previous approval of this site by the geographical societies of France, of Bremen and of America, each of which had expressed a desire that our government should equip an expedition to establish a station at that point, as being the most favorable for the joint objects of scientific investigation and geographical exploration that could be reached or maintained at so high a latitude. The advantages to follow a systematic series of scientific observations within the polar area, are too evident to require extended argument here. To obtain profitable results from work done within this area, or elsewhere, it is important that it should be regularly and systematically done for a period of years. From observations long continued it becomes possible to deduce general laws for the guidance of future observers, and for the advancement of scientific research. Fragmentary series of observations, or those made for brief periods of time, however interesting in themselves, are practically valueless, and the time and labor spent in collecting them virtually thrown away. Work within the scientific field must be done with the same energy and persistence of purpose that is required to achieve success in what are termed the more practical pursuits of life. It is for this reason that the writer has advocated for several years past, the official establishment of a scientific station within the polar area as far north as it is practicable for a steamer to go annually without needless risk of life or property; and the maintenance of this station for such length of time as might be found necessary or desirable for the collection of reliable scientific data, and for the thorough exploration and survey of that portion of the globe lying beyond the limit reached by the English explorers of 1875-6.

The proposed location of the station is upon the shore of Lady Franklin Bay, in about Lat. 81° 40′, and near the winter quarters of the ship Discovery, of the English expedition. A fine deposit of coal exists at this point, which will furnish an ample supply of fuel for heating purposes, thus removing one of the greatest difficulties hitherto experienced in arctic exploration. This deposit of coal is easy of access, being exposed on the bank of a ravine for a distance of over two hundred yards. At its greatest exposure the thickness of the seam is twenty-five feet, but its depth below the level of the small stream that flows through the ravine is unknown, as no steps were taken by its discoverers to ascertain its extent. The coal was pronounced, after trial by the engineers of the Discovery, to be equal to that from the best Welsh mines. The exposed portion of the seam is at an elevation of two hundred feet above the sea level, and at a distance of about a mile from the shore of a small bay in Robeson Channel, and of four miles from the winter quarters of the Discovery.

Properly supplied with good buildings, abundance of provision, clothing and fuel, the occupants of the station would not be exposed to greater hardships than

have hitherto been surmounted by the intrepid explorers of the arctic regions, or by explorers of regions in much lower latitudes. There are no probable contingencies of weather or climate that cannot be foreseen and prepared for by using the experience of former expeditions, and the horrors of the long arctic night will in great part disappear before the kindly influence of improved appliances for comfort and amusement now available.

The lowest temperature reported by the English expedition as experienced at the site of the proposed station was —70°.8, which is not relatively colder than the temperature frequently reported by observers in Minnesota and other northwestern portions of the United States, and cannot of itself be considered an insuperable obstacle to the permanent occupation of the station.

Capt. Nares reports the existence of an unfrozen fresh water lake about five hundred feet above the sea level, near the seam of coal to which such frequent reference has been made, and the large amount of game killed by the crew of the Discovery while in winter quarters indicates the presence of sufficient vegetation to sustain animal life even during such exceptionally cold seasons as that in which the English wintered there. There seems to be no reason for doubting that the health and comfort of men can be secured at the proposed station as effectually and cheaply as at many of the frontier posts now occupied by United States troops.

With reference to the prosecution of surveys beyond the northern limit already reached, it is interesting to note that from the few observations already made in the northern part of Smith's Sound, it would appear the line of greatest cold is reached in about latitude 78° N., and that beyond that point the mean annual increase of temperature is a little more than two degrees Fahrenheit for each degree of latitude. If this proves to be true on closer and more extended observation, and the rate of increase continues to the pole, the climate there would not be incompatible with the existence of animal and vegetable life. In ordinary seasons it is not expected that there will be any serious difficulty in reaching the station by the aid of a steam vessel, especially fitted for the work, and the vessel can carry out annually supplies of fresh provisions, clothing, books implements, and if need be, fresh details of men, to replace those who may wish to be relieved. The work of observation and survey will furnish constant and useful employment for the men, and render them less liable to attacks of homesickness, after the first feeling of isolation wears off and they become accustomed to their surroundings and duties. With sledges, dogs, boats, and captive balloons, they will be enabled to avail themselves of any opportunity that may offer for pushing their way north—even to the pole itself, and thus settling finally the mystery now surrounding it. Aside from the object of geographical discovery—in itself a sufficient motive for the establishment of the station, the following are some of the benefits that it is expected will accrue to science by the work it will render possible:

1. With regard to a better determination of the figure of the earth, pendulum experiments are required in the region in question.

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2. The magnetism of the earth requires for its better elucidation a larger number and more continued observations than have yet been made.

3. To complete our knowledge of the tides of the ocean, a series of observations should be made for at least an entire year.

4. For completing our knowledge of the winds of the globe, the results of a larger series of observations than those we now possess are necessary, and also additional observations on temperature.

5. The whole field of natural history could be enriched by collections in the line of botany, mineralogy, geology, etc., and facts of interest obtained with regard to the influence of extreme cold on animal and vegetable life.

All of the above named branches of science are indirectly connected with the well being of man, and tend not only to enlarge his sphere of mental pleasures, but to promote the application of science to the arts of life. There is scarcely a problem relating to the physics of the globe which can be fully understood without a knowledge of the phenomena within the polar regions. Whatever phenomena we may wish to investigate, it is of special importance to determine its maximum and minimum values, and in nearly all questions of terrestrial physics one or another of these values is found in the neighborhood of the pole. If, for example, we wish to determine the distribution of temperature upon the surface of the globe, it is specially important to determine the extremes of temperature, one of which is to be found near the equator and the other near the poles. If we wish to investigate the system of the circulation of the winds, our investigations would be sadly deficient without a knowledge of the phenomena in the polar regions.

If we wish to study the fluctuations in the pressure of the atmosphere, whether periodical or accidental, we cannot be sure that we understand the phenomena in the middle latitudes unless we know what takes place in the polar regions. If we wish to investigate the currents of the ocean, we find indications of currents coming from the polar regions, and it is important to be able to trace these currents to their source. If we wish to investigate the laws of the tides, we need observations from every ocean; and observations in the Arctic regions have a special value on account of their distance from the place where the daily tidal wave takes its origin. If we wish to study the phenomena of atmospheric electricity, and of auroral exhibitions, no part of the world is more important than the polar regions. If we wish to study the phenomena of terrestrial magnetism, observations in the polar regions have a special value, since it is here the dipping needle assumes a vertical position and the intensity of the earth's magnetism is the greatest. If we wish to determine how the force of gravity varies in different parts of the world, we require observations of the second's pendulum both where it is greatest and where it is least. In short, there is no problem connected with the physics of the globe which does not demand observations from the polar regions.

The subjects to which I have here referred are scientific rather than commercial, but many of them have an important bearing upon questions which affect the

commerce of the globe. In the attempts which are now being made by the joint efforts of the principal nations of the globe to determine the laws of storms, if we could have daily observations from a group of stations within the Arctic circle, it is believed that they would prove of the highest value in enabling us to explain the phenomena of the middle latitudes. Every winter, upon the eastern side of the Rocky Mountains we find an intensely cold wave moving down from the northward and spreading over a large portion of the United States. How can we fully understand the cause of the great changes of temperature which so frequently occur during the winter months, unless we know where this cold air comes from? And how can this be determined without fixed stations of observation extending northward over the polar regions?

The vast extension of the commerce of the world in recent times and its increased security are due in no small degree to more accurate information respecting the physics of the globe, including such subjects as the mean direction and force of the prevailing winds, the law of storms, the use of the barometer in giving warning of approaching violent winds, the surest mode of escaping the violence of a storm when overtaken by a gale, the most advantageous route from one port to another, the direction and velocity of the current in every ocean, the variation of the magnetic needle in all latitudes, and its changes from year to year, together with many other problems. And most of these investigations have been greatly facilitated by observations which have been made within the Arctic regions.

While the cost of establishing, equipping and maintaining the proposed stations is inconsiderable to the government, which has already its vessels, men and material that can be used for the purpose without adding a dollar to the annual appropriations, it is too great for the class of citizens most directly interested in the work, as they would be compelled to purchase outright everything required and bear the continued expense of ma ntenance, etc.

The work proposed is for the nation's honor and for the nation's benefit, and its cost should therefore be borne by the government. This matter I have urged upon Congress so often and so fully that further reference now seems unnecessary, except, perhaps, to say that favorable legislation will receive popular support, and will reflect honor upon its advocates and supporters. Let the necessary legislation be provided, and the United States be the first to carry into effect the wishes of the Geographical Congress.

AFRICAN EXPLORATION.

Professor Gerhard Rohlf's expedition, sent out by the German-African Society, having explored the Kufara Oasis, was there set upon and plundered. Prof. Rohlf was consequently compelled to return to Benghasi, though he hoped to receive help and compensation from the Turkish provincial government.

STANLEY'S LATEST PROJECT.

Mr. Donald Mackenzie has arrived in London from Cape Juby, and reports that the new settlement there is progressing very favorably. Sheikh Mohammed has built a house for himself at Cape Juby. Sheikh El Mohady, eldest son of the Sheikh Mohammed Ibn Bairook, accompanies Mr. Mackenzie on a visit to England, and has with him a native servant. Sheikh Mohammed Ibn Bairook is directly descended from Abd-el-Kader, and rules over some of the most important and powerful tribes in that part of the country. This is the first occasion that any of his family have visited England, and Mr. Mackenzie believes it will prove highly beneficial to the development of increased and permanent trade with the Soudan. A letter has also been received from Mr. Henry M. Stanley, the explorer. It is dated from Banana Point, at the mouth of the Congo river, September 13, and says:

"All this year I have been very busy and have worked hard. I have equipped one expedition on the East Coast, have reconstructed another—namely, the International, of whose misfortunes we have heard so often—and have explored personally several new districts on the East Coast. Having finished my work satisfactorily to myself, my friends and those who sent me, I came through the Mediterranean and around to this spot, where I arrived two years and four months ago, on that glorious day on which we sighted old Ocean after our rash descent of the Livingstone. And now I begin another mission seriously and deliberately, with a grand object in view. I am charged to open—and keep open, if possible—all such districts and countries as I may explore, for the benefit of the commercial world. The mission is supported by a philanthropic society which numbers noble-minded men of several nations. It is not a religious society, but my instructions are entirely of that spirit. No violence must be used, and wherever rejected the mission must withdraw to seek another field. We have abundant means, and therefore we are to purchase the very atmosphere, if any demands be made upon us, rather than violently oppose them. In some regions, experience tells me the plan may work wonders. God grant it success everywhere! I have fifteen Europeans and a couple of hundred natives with me."

GEOGRAPHICAL NAMES.

At a recent meeting of the Indian Council it was resolved by the Secretary of State that the "Hunterian," or "modified Jonesian system," should henceforth be adopted for all official purposes. This system is fixed in the *Imperial Gazetteer of India*, upon which Dr. W. W. Hunter is now engaged, and the printing of which is far advanced. At the same time Sir Barrow Ellis and Dr. Hunter, with others, have been appointed to represent India on the Committee of the Royal Geographical Society, which is engaged in introducing a similar measure of scientific uniformity into the spelling of names in the other countries of the world.

NEWS OF THE JEANNETTE.

The whaling bark Dawn reports from San Francisco that on September 3, within twenty-five miles of Herald Island, she saw the smoke of a steamer, supposed to be the Jeannette. About September 25, the ice began to open rapidly to the north; could not see any ice between us and Wrangell-land, and were much surprised, as the outlook was very discouraging in the first part of September. I now think the Jeannette will reach land, and we may expect to hear from her next year..

LOSS OF THE FLORENCE.

Information has been received that the schooner Florence, which formed the preliminary Polar expedition of Captain Howgate, in 1877–8, but since her return employed as a whaler, has been lost in Cumberland Straits, to the east of Hudson's Bay. She parted her chains and went ashore during a gale. Nobody was lost. The crew landed safely, but suffered subsequently greatly from exposure. They stripped the vessel, made tents of her sails, and stayed near the wreck for three days, when they were rescued by a passing vessel, which took two of them to Peterhead, Scotland, whence they came to this country by a State Line steamer. The remainder of the crew are expected in Scotch vessels at Peterhead, whence they will be sent here.

GEOLOGY AND PALÆONTOLOGY.

"ARE BIRDS DERIVED FROM DINOSAURS?"

BY DR. S. W. WILLISTON, NEW HAVEN, CONN.

I have read with interest an article in the August number of this magazine upon the above subject, by my friend Prof. B. F. Mudge. Unlike most writers opposed to the doctrine of evolution, Prof. Mudge's views are conscientiously drawn from purely scientific grounds, as a long and pleasant acquaintance with him fully assures me, and as such are worthy of careful consideration.

The confused state of general literature upon the palæontology of vertebrates, a science yet in its infancy, has led the Professor into a few misapprehensions, and I will here endeavor to give the views now held to sustain the Dinosaurian genesis of birds.

The relationship of dinosaurs and birds was pointed out and ably discussed by Prof. Huxley in 1861, and the replies of Prof. Owen are well known. The

additions to our knowledge of these extinct forms since then, though they may modify his reasons somewhat, have not destroyed their cogency. Anatomists, however, are not prepared to state the evolution of birds from dinosaurs as a geological fact, but its soundness as a theory, it seems to me, cannot be readily questioned.

The persistence of certain geological types is constantly adduced by its opponents as contrary to the belief in Derivation. That many genera, possibly species, of low forms have persisted, even from palæozoic times to the present, proves not that they were immutable, but that their surrounding circumstances remained the same—that they filled places in nature that no other types could replace. The true dinosaurs came into existence in the Triassic, and continued as a type to the very close of the Cretaceous, simply because in the struggle for life their place was not invaded; but, on the other hand, at any time during that period they may have given off branches that developed upward into birds, or, possibly, downward into the less specialized sauropoda. While some became birds, there was still a place for others as dinosaurs, and, as such, others filled it. That the type of dinosaurs should have progressed harmoniously into birds, as the child disappears in the man, at first sight may seem reasonable enough, but if we follow such views to their logical conclusions, the absurdity is apparent. If there had been no splitting, or divergence of types, man to-day would be the only form of life upon the globe—the result of harmonious progression from the lowest to the highest. Hence it will be readily enough seen that for dinosaurs to become extinct upon the appearance of birds, is precisely contrary to what we should expect.

But few now believe in the avian origin of the Connecticut valley Triassic footprints. They were undoubtedly made by dinosaurs and of highly developed forms, as their osseous remains show (*Megadactylus*). The earliest known birds are the species of Archæopteryx, from the Jurassic of Solenhofen. Hence, with our present knowledge, there was an abundance of time for a development to have occurred. These earliest birds, of which but very few species have been discovered, are of a far lower or more reptilian type than any now living, and have been properly placed in a distinct sub-class. The Archæopteryx was a bird covered with scale-like feathers, and possessed of reptilian-like teeth set in sockets, wings with four functional fingers, and a long slender vertebrated tail. The next forms of birds now known are from the Cretaceous, of which, probably, none can be classed among the modern forms. In the Hesperornis, from Kansas, we have birds with teeth and very rudimentary wings. Their bones were also solid, a peculiarity yet found in the penguin and allied forms. In the Ichthyornis, from the same locality and horizon, in addition to teeth, we find the neck vertebræ biconcave, a peculiarity reptilian as well as ichthyic.

The Professor errs in drawing any comparisons from the sauropoda. They are not true dinosaurs, and may eventually be entirely separated from the order.

It is very true that scarcely a single trait of structure runs through the whole

of Dinosauria; but that fact does not affect the relation existing between the most avian dinosaurs and the most reptilian birds. One would not compare a turtle with an eel to show the resemblance between reptiles and fishes.

About ten thousand species of living birds are known; but from the earlier geological ages we are acquainted with scarcely a dozen in any degree of completeness. As I have stated, these few forms are the most reptilian, and they certainly give us no reasonable grounds for supposing that other, and numerous, undiscovered contemporaneous forms were of the modern specialized types. While it may be said that there is not a single persistent typical element of structure common to both classes, it may also be said that there is scarcely a single persistent element of structure now known to separate them. As reptilian characters among birds, we have: long bones solid; wingless, or wings with four functional fingers; long, slender, vertebrated tail; slender, recurved teeth, set in sockets; vertebræ biconcave; ischial and pubic bones with free extremities; fibulæ free from tibiæ and descending well toward the tarsus; three toes, all directed forward, etc. As avian characters among the highest forms of dinosaurs: long, slender, very hollow bones; fore legs very short, feeble, and not used in locomotion; sacrum of numerous consolidated vertebræ; ischiæ and pubes directed backward and parallel; femora shorter than tibiæ and with fibular ridges at lower extremities; fibulæ slender and partially united to tibiæ (Marsh); astragali united to tibiæ (*Ornithotarsus*); three toes only. Many of these resemblances are important and can scarcely be called accidental. About the only persistent characters of any degree of importance among birds are the early ossifications of the pelvic and metatarsal bones.

Of the nature of the sternum among dinosaurs we have little definite knowledge. It, as well as the skull, is known in a very few species. That it may be birdlike in the true dinosaurs, is evident from the Sauropodous Ceteosaurus, where it is broader than long. Indeed, in Palæontology, we can predicate but little from the absence of any anatomical feature, as the clavicle among dinosaurs. Future discoveries may very materially change our pre-conceptions based upon negative evidence.

It is not difficult to understand how the fore legs of a dinosaur might have been changed to wings. During the great extent of time in the Triassic, in which we have scanty records, there may have been a gradual lengthening of the outer fingers and greater development of the scales, thus aiding the animal in running. The further change to feathers would have been easy. The wings must first have been used in running, next in leaping and descending from heights, and, finally, in soaring.

It is not necessary to suppose that birds came into existence before mammals, or even that the latter were derived from true reptiles. There is certainly no reason why lower types may not have succeeded higher ones. The theory of Derivation does not necessarily mean unbroken progression, but rather adaptation to circumstances. The absence of teeth among mammals may indicate degrada-

tion, for their presence and use usually require greater mental and muscular activity. The absence of teeth among birds is a specialization brought about by changed habits of life, and does not mean degradation. The rank of any species cannot be based upon any single detail of its anatomy, but only upon its assemblage and complexity of characters.

NOTES ON SURFACE GEOLOGY OF SOUTHWEST MISSOURI AND SOUTHEAST KANSAS.

BY PROF. G. C. BROADHEAD, PLEASANT HILL, MISSOURI.

The Ohio and Mississippi rivers are recognized as forming the southern boundary of Glacial agency in the Central States. Rarely along the southern bank of the Missouri river are found small boulders of igneous rocks, such as granite, greenstone and quartzite. In the States north of these rivers are nearly everywhere found accumulations of sand, gravel and rounded boulders, chiefly of igneous rocks.

In the western part of Missouri, and extending into Kansas, are found, along the valley of the Marais des Cygnes, occasional deposits of rounded flint gravel, in fragments not often larger than two inches diameter and generally of smaller size. These deposits chiefly abound on the hills or valleys at an elevation above all known high waters, and are often associated with reddish clay. In the eastern part of Bates county, Missouri, these gravel beds are found on high hills, 200 feet above the Marais des Cygnes valley, or 800 to 900 feet above the sea. Near Carthage, Missouri, a similar gravel bed is found 75 feet above the valley of Spring river.

In Miami and Anderson counties, Kansas, the gravel is very abundant on the upper terraces of the Marais des Cygnes river and its tributaries, at 30 to 70 feet above the valleys. In the western part of Miami county, on the ridge between the Pottawatomie and Marais des Cygnes, the gravel bed is 9 feet thick, and lies 50 feet above the valley of the Pottawatomie, and at least as many feet above all known high water.

On the Marais des Cygnes and its tributaries, in eastern Kansas, there are at least two well defined terraces, one at 20 feet to 40 feet above the stream, and the other about 50 feet above the first. The lower is richer alluvium; the upper valley, often wide spread, is of clay soil, overspread or else having just beneath the surface a deposit of water-worn pebbles. The receding hills are over a hundred feet higher. The elevation of the second terrace is about 900 feet above the sea.

South of Garnett, in Anderson county, Kansas, the gravel seems to be everywhere present at a general elevation of about 1,050 feet above the sea. In the valley of the Neosho river, at Neosho Falls, there occurs a deposit of sand and gravel of several feet thickness, lying at about an elevation of 1,000 feet above the

sea, or 30 feet above ordinary water in the Neosho river, or 8 feet above high water. Similar deposits occur near the Verdigris river, at Toronto, at about the same elevation above the sea and above all known high water of the Verdigris river. In the Fall river valley, at about 1,100 feet above the sea and above all known high water, there also exist deposits of rounded, flinty gravel. The quantity seems less at the western outcrops, and the elevation of the uplands above the sea level increases.

Now, whence this gravel, and how its presence?

Extending into Kansas from the south, along the lines of Cowley, Chautauqua, Elk, Butler and Greenwood, and northwardly, is a dividing ridge, known as the "Flint Hills," much higher than the country either east or west, and covered over with angular fragments of flint, chiefly of the age of the Upper Permian. The hills are mainly composed of limestone and shale beds of the age of Permo-Carboniferous, and form the eastern extensions of these rocks. It is probable that the rounded flint has partly originated from these hills, and is also partly derived from the other Upper Coal Measure rocks lying just eastward. The Coal Measure rocks of Miami county contain on the highest hills, a good deal of chert.

The elevation of the Permian ridge, above named, along the line of Cowley, Elk, Butler and Greenwood counties, varies from 1,550 to 1,700 feet above the level of the sea, being highest in the southwest corner of Greenwood, or 1,700 feet, and about 1,565 feet in the southwest part of Elk county, and not quite as high in the western part of Greenwood county.

These remarks are but preliminary, for these deposits require much study, and it yet remains to precisely determine their source and age. The pieces are rarely fossiliferous, but when any organic remains have been observed they tend to show the pieces to be derived from Coal Measure rocks. But the geological age is probably Later Glacial, or just previous to the Loess; but we have not now positive proof of that.

WESTERN KANSAS—ITS GEOLOGY, CLIMATE, NATURAL HISTORY, ETC.

BY EDGAR W. GUILD, MONUMENT, KANSAS.

It is still an open question whether the appellation of "Desert," as applied to the plains country of western Kansas and eastern Colorado, was altogether inappropriate. A succession of long and high divides, raised ages ago by a corresponding succession of internal waves, with long slopes on their south sides and breaking abruptly into short cañons on the north, devoid of timber and water, and covered principally with the short buffalo grass, cactus, and a stunted variety of resin weed, the grass not unfrequently dry enough to burn by the middle of July, certainly comes nearer to being a Sahara than an Egypt, and, to make it the earthly paradise that enthusiasts predict, will certainly require a thorough understanding of its atmospheric peculiarities.

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From its geographical position, it is, and will be, subject to severe drouths—not so much from lack of adequate rainfall, for it is a region equally subject to severe storms, as from imperfect distribution, both local and geographical, coupled with excessive evaporation. There are dry spots during wet years, and *vice versa*, but it is too much a region of extremes for the golden mean to be often reached, and there are natural agents that to overcome will require persistent and intelligent warfare.

Assuming that rain is the only requisite, there is, with rare exceptions, sufficient yearly for vegetative purposes, could it come at proper times and be evenly distributed and less rapidly evaporated. But it is characteristic that when it does rain it comes in excessive quantities, is more or less local in its nature, and the result, usually, is a protracted dry spell for the locality favored.

The violent hot and dry south and southwest winds play a prominent part in checking vegetation, from the excessive evaporation they produce, not only from the soil, but also from the plant, thereby stimulating to the extent of overworking its organic system and producing a dwarfed, distorted growth, if not actual destruction. This is plainly evidenced by the timber of the region, which, though meager in quantity, is characterized by growing principally to crooked branches, and to low, scraggy, ill-nourished forms. Corn—and it must be true of any plant that presents a large surface above ground in proportion to its root—shows the destructive effects of rapid evaporation, even when the soil is not lacking in moisture. An examination of ground broken to a depth of ten or twelve inches, upon which no rain had fallen for six weeks, showed at a depth of three inches ample moisture for plant life under favorable atmospheric conditions; yet the plants there represented bore that unmistakable appearance of general debility so commonly met with higher in the scale of vegetable life.

Considering the country in relation to agriculture, the outlook is certainly far from prepossessing, though not beyond a partial solution. Excellent soil, particularly on high level divides, and land ready for the plow, are about the only natural advantages that can be claimed. Timber, for fuel and wind-breaks, will have to be raised, and water, though usually obtainable, is only found by digging to considerable depth. Water, and occasionally a few trees or bushes, can usually be obtained along the larger streams and their cañons; but the valleys are very narrow, and the inferior quality of the soil, it being largely composed of the washings of chalk beds, the limited quantity of arable land, together with distance from railroads, make this small portion of little significance when considered agriculturally.

Though offering so few inducements to the farmer as to make it well worth his serious study ere he attempt to found a home there, yet the region does offer great natural inducements for stock raising and grazing purposes. The short but nutritious buffalo grass, with which the greater part of the country is covered, is thoroughly cured before frost, a result of the dry climate, and affords a winter pasturage accessible at nearly all times. Water, along the streams, is plentiful

enough for stock purposes, and the high bluffs and deep, narrow cañons afford excellent shelter from the short but violent winter storms, while the vast quantities of grass-fattened beeves that are annually shipped are ample evidence of its adaptation to summer grazing.

Could the western one-fourth of Kansas have been set apart for stock purposes, it would have conduced far more to the general prosperity than if left open to a partial settlement from which no revenues, proportionate to the labor, will be received by the settler, and no material benefit accrue to the State. As a stock producing region it would have been unequaled, and, as such, would have added great wealth to the State and material prosperity to the farmers by affording them a permanent market for their surplus products, besides increasing the value of their land by inducing a more thorough settlement of the eastern portion of the State.

The western portion of Kansas can be considered as possibly agricultural to about the extent of the uncertainty of deciding where possibilities end and impossibilities begin. But it is questionable whether it is wise now to attempt the solution of the problem, since to make it a farming country is to build an uncertain empire on the ruins of another and equally important one, whose success is assured and whose limits are already sufficiently narrowed.

Many theories have been advanced to account for the absence of timber throughout the plains region, and no one of the many proves satisfactory of itself. It is only by considering them as a whole that their true value appears. The Third Cretaceous, which is the oldest formation exposed, gives but little evidence of timber or vegetation of any kind. It is, of course, impossible, with our present knowledge, to define the precise limits of the shallow Cretaceous sea, but certain it is that the western one-fourth of Kansas was nearly, if not entirely, inundated, and vegetation necessarily scarce. Further proof may, perhaps, be found in the fact that the animal life represented was essentially marine and carnivorous.

The Later Tertiary period (Pliocene?), which is comparatively recent, must have been more prolific in vegetation, if only to have supplied the vast number of herbivorous mammals represented, yet there is but little evidence of timber. If ever abundant, it must have been at that time, unless we accept the theory that the unrepresented divisions—fourth, fifth and sixth—of the Cretaceous, as well as all the Tertiary below the Pliocene (?), have been washed out, which savors too strongly of "catastrophism."

From the records, both past and present, we can only conclude that timber has been but sparsely represented during the million or more years that have elapsed from the close of the Cretaceous to the present time. It is certain that all vegetation was strongly affected during the upheavals and climatic changes which followed the close of the Tertiary, changes produced by the raising of the Rocky Mountains to essentially their present form, and the consequent drying of the fresh water (Tertiary) lakes. The scattering groves of gnarly, distorted cot-

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tonwoods, which now constitute the principal timber of the western one-fourth of Kansas, cannot, then, be the lineal descendants of a once mighty race covering the same area of country, but, instead, are pioneers—and decidedly ill-used ones—pushed westward from the east into a region that now, as for ages past, affords more agents for their destruction than propagation. Nor is it probable, without human intervention to assist in combating their natural enemies, that any greater foothold will be obtained for ages to come.

The injurious effects of the annual prairie fires upon timber are so plainly apparent that they must be ranked first among the destructive agents. Could they be stopped, a period of ten years would make certainly a noticeable change in the valleys and cañons, though the improvement would be in quantity rather than quality, since checking the fires would not affect, to any great extent, violent hot and dry winds, which, producing so much evaporation, compel a tree to be either a brush heap or nothing.

In addition to the fires and scorching winds, there is Prof. Lesquereux's theory—which was proposed as a partial solution—of the extreme fineness of the soil of the valleys, it being here largely composed of the washings of chalk-beds. Undeniably, a soil of that class, presenting at nearly all times a hard, dry, unbroken surface, affords but little opportunity for seeds to germinate, nor would it furnish much nourishment to the plants; and even were they favored by excessive rains, which is sometimes the case, and so obtain a foothold, they would be pretty certain to succumb to the first dry season, since a soil of that class absorbs but little, and it requires a heavy rain to penetrate the unbroken sod to the depth of an inch.

In tracing the timber from the eastern portion of the State, where it is quite abundant along the streams, to the extreme western portion, where it almost entirely disappears, it is noticeable how persistently the cottonwoods hold on, solitary ones appearing for a considerable distance beyond the little bushy hackberries, which are next in order of appearance. Proceeding east, the hackberries become more thrifty, followed by ash and elm, and by the time the oaks appear the streams are comparatively well timbered, the valleys have increased in width, and the chalk has disappeared, giving place to the harder limestone of the Fort Hays group of the Niobrara.

The persistency of the cottonwoods may be traced to the greater facility with which their seeds are transported by the winds, and their rapid growth, which enables them to get a sufficient start during a wet year to withstand a dry one. They are also less troubled with borers (beetles) than the hackberries, though that advantage is about offset by the injury they receive from porcupines.

The natural history of the region is too varied and extensive to admit of anything but a hasty survey. It is certainly surprising that a country so noted for its barrenness and lack of natural attractions should be so prolific in animal life. The few remaining buffalo are principally confined to the southwestern portion of the State, occupying a long, narrow plateau which constitutes the divide between

the Smoky Hill and Arkansas rivers. Though almost destitute of living water, there they remain, ranging west into Colorado, but rarely reaching Beaver creek, on the north. The locality is favorable to their preservation and increase, from its extreme barrenness. It is also a favorite retreat for large bands of wild horses. The stallions and many of the mares are as typical of their race as can be found, and they breed extensively. They are frequently captured, by a process known as "walking them down," which is usually accomplished by starting them early in the spring, and following them persistently, never running, but aiming to keep them continually on the move. By using grain-fed horses, the hunters have quite an advantage, and ten to fifteen days will tame a band so that they can be driven in any desired direction and corralled, providing the weather is propitious, the violent rain and hail storms so common to the spring-time occasionally stampeding a band when the goal is almost reached. Recently escaped horses, the property of emigrants, hunters and ranchmen, are frequently taken with them, and once a mare gets with a band she is most effectively herded by the stallion, and he will fight valiantly for her, nor permit her recapture until he is overpowered. The practice among buffalo hunters, when their horses escaped to the wild ones, was to shoot the stallion if possible; otherwise they stood but little chance of regaining their stock.

Antelope are very abundant, and fortunately these interesting animals are in no immediate danger of extinction. Eventually they will be domesticated for profit. Mule deer (*Cervus macrotis*,) are frequently met with along the Smoky River, the deep rocky cañons affording them excellent protection. They are not the true Blacktail, (*Cervus Columbianus*,) though usually so termed. Elk have disappeared since the influx of settlers drove them from the timbered valleys of the Saline River and its tributaries. Even when plentiful they were seldom met with in the portion of the State of which this article treats.

Of the carnivorous, there is a decrease in the two species of canidæ (*Canis occidentalis* and *C. latrans*), which were excessively abundant during the flush times of the buffaloes, though both are well represented yet, the latter more plentiful and less given to roaming and dogging the footsteps of the buffaloes than their big brothers—the grays. The swift *Vulpes velox* is the sole representative of the vulpidæ, as also are the skunk, badger and raccoon of their respective families.

During the summer of 1872 there was no little excitement caused by the prevalency of mad skunks. The epidemic reached its height the following season, and since 1874 there have been few if any cases in this region. Previous to 1872 skunks were avoided for obvious reasons, but not regarded as dangerous except to the olfactories. The many fatal cases since have put a brand on them that is likely to remain to the end of their race. They are yet regarded as far more dangerous to man than the rattlesnake, and well they may be, since the bite of the latter need not be fatal if taken in time and proper remedies can be had; while that of the skunk, *if mad*, is certain and horrible death in every case. There are said to be over fifty cases of death from skunk bite on record, and it is probably

far from an exaggeration. The causes which produce madness in animals, and particularly why inoculation should be so universally fatal, are as yet imperfectly explained. The trouble with the skunks may have been strychnia. The physiological action of the drug is of a nature to justify the supposition, and large quantities of it were used for poisoning wolves both before and during the infected period. The civet cat and red lynx complete the list of Carnivores animals. The former is very rare, the latter quite common.

Of Rodents, there are two species of rabbit—the jackass (*Lepus campestris*) and the cotton tail (*L. sylvaticus*). In addition, porcupines, beavers, musk rats, prairie dogs, spermophiles, moles, rats, and notably the remarkable jumping rat (*Zapa Hudsonia*), representatives being as usual far in excess of any other mammalian order.

Aquatic birds are abundant during migration wherever there are ponds of water. Three species of ducks (*Querquedula discors*, *Q. Carolinensis* and *Spatula clypeata*), occasionally remain through the breeding season, during which a great variety of terrestrial and aerial birds can be found. Of Waders, there are cranes, herons, stilts, snipes, sandpipers and plovers in abundance. Among the latter, *Aegialitis Montanus* is remarkable in spending the entire breeding season on the divides, completely isolated from water, while their near relatives, *A. vociferans*, are rarely seen away from that element.

Rasores are best represented by the sharp tailed grouse (*Pediœcetes phasianellus*, var. *Columbianus*), which is a resident, though never abundant. Quail occasionally appear, and prairie chicken are reported, though I have never positively identified the latter. The western range of both is limited from lack of proper food. The diurnal among birds of prey are represented by vultures, hawks, falcons and eagles, and four or more species of owls of the nocturnal. Scansores are limited to woodpeckers and the yellow billed cuckoo (*Coccygus Americanus*). Of the five species of the former the red headed and golden winged are most abundant. They are both adepts at catching grasshoppers, taking them on the wing as neatly as the fly catchers.

The varied and extensive order of Insessores is well represented, the more noticeable ones being the tyrants (*Tyrannus verticalis* and *Carolinensis*), mocking birds (*Mimus Polyglottus*), orioles (*Icterus Baltimorii* and *Bullockii*), Brewer's black bird (*Scolecophagus cyanocephalus*), horned larks (*Eremaphila alpestis*), meadow larks (*Sternella magna* var *neglecta*), cliff swallows (*Petrochelidon lunifrons*), and rock wrens (*Salpinctus obsoletus*).

Of the true reptiles Chelonia are represented by the soft turtles of the streams and the land or box tortoise. Testudo Lacertia by short tailed road lizards (*Sceloporus*), which are very common, and another handsome species with long and slender tail and the sides of the body striped with yellow and green. It is principally an inhabitant of the chalk slides. The most characteristic of the Ophidians are the rattlesnake (*Crotalus confluentus*) and the blue racer (*Bascanion flavventris*), both of which are commonly met with on the highlands. The latter is preyed

upon by the California squirrel hawk (*Archibuteo ferrugineq*). Mr. S. W. Williston has called my attention to a peculiarity of the blowing adder or hog nose (*Heterodon nasicus* var *simus*), which he thinks has never been noted, of opening the mouth so widely, when bothered, as to cause it to bleed. This action is usually accompanied by contortions which draw the body into a knotty ball that no amount of persuasion with a stick—an experiment I have often tried—will induce them to disentangle. There is the usual complement of grass and water snakes, the region not differing materially in that respect from the more timbered localities in the eastern portion of the State, the principal absentee being the copperhead (*Agkistrodon contortrix*).

Among Amphibia the most noteworthy species is one of *Amblystoma*, somewhat smaller than *mavortium*, which I have found together in the same pool, both in the larval or siredon state and in the adult.

Among insects, the plains most forcibly show a blending of Atlantic and Pacific fauna. The dryness of atmosphere and lack of abundant vegetation cause the true dividing line between eastern and western types—the Rocky Mountains having far less influence. A few characteristic forms among Coleoptera are the rare *Amblychila* and numerous species of cicindelæ, the *Asidæ* and *Eleodes*, abundant both in species and number, insects highly capable of withstanding dessication; and the many species of Meloidæ, most of which are probably parasitic upon the numerous Acrididæ; among Orthoptera, conspicuous forms of which are the walking sticks and clumsy locust (*Branchy peplus*). Among Hymenoptera, the burrowing wasps and Mutillariæ; among Diptera, the Bombylidæ and Asilidæ are especially noticeable.

In conclusion, unwonted enthusiasm has made Western Kansas a most fertile and prolific region—on paper. It is not the aim of the present article to disparage, but simply to note such facts as are apparent to the most casual observer. Mere local improvement, such as breaking a few hundred or thousand acres of sod, is not likely to produce any great change, beyond absorbing the moisture that does fall, instead of allowing it to be principally drained off, as is the case when the sod is unbroken. That the moisture evaporated from a given locality will return thereto in the form of rain, is highly improbable, to say the least, particularly when considering that it will be greedily absorbed by a violent wind. Like may attract like, but it is hardly an axiom; nor would it signify in this case if it were, since for surface moisture to influence atmospheric, it is first essential for the atmosphere to be charged with the same. It is practicably impossible for a cloud charged with moisture to pass through the warm and dry strata of air overlying the plains without absorption taking place, and it is a significant fact that clouds are rare unless accompanied by storms. Hence any increase in rainfall can only be brought about by a corresponding increase of rain bearing clouds. As the clouds must originate and obtain their moisture in other localities, it becomes evident that the climatic change promised Western Kansas would be universal to the extent of the region drawn upon to effect it.

MEDICINE AND HYGIENE.

DRINKING WATER IN CITIES.—ITS BENEFICIAL AND ITS DEADLY QUALITIES.*

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Just at present, owing to the unusual amount of sickness, chargeable to malaria and malarious influences, existing in the community, an inquiry into its possible causes will not be without interest. Although the word malaria implies simply an unhealthful condition of the atmosphere, yet it has by common usage come to comprehend all influences so affecting the human system as to produce certain classes of zymotic diseases which will be more particularly referred to hereafter.

The principal causes of such diseases are believed to exist in the water we drink and the air we breathe. This paper will be devoted to a consideration of the former, including a classification of potable waters in cities, an examination of their respective merits as regards their action upon the human system when of normal quality, their deleterious constituents when abnormally affected by the air and soil of cities, the effects upon the system of these deleterious constituents when taken into the stomach, conclusions drawn from these examinations, indicating the best and most healthful of the different waters for potable purposes, and finally an attempt to point such artificial means of purifying these waters as have been suggested by others and have occurred to myself.

Potable waters in cities are obtained from cisterns, wells and hydrants, and are usually regarded as comparatively pure in the order named—rain water being classed first, well water second, and river water third. How well this theory or belief is sustained will appear later.

A good, drinkable water is described as follows: "It is perfectly colorless and transparent, without smell or appreciable taste, but agreeable and not insipid or flat, does not lose its clearness by boiling and leaves a very slight residue upon evaporation." Drinking water, in addition to freedom from all organisms, from ammonia, nitrous acid and sulphuretted hydrogen, should not exceed eighteen to twenty degrees of hardness.

Rain water is naturally the purest of all for ordinary use; but unless special pains are taken in collecting and storing it, it is liable to contamination from a variety of sources, such as absorption of deleterious vapors and impurities from the atmosphere of localities largely occupied by manufacturing establishments, smelters of ores, etc., also from the dust, organic matters and other deposits washed from roofs into the cisterns; also from the salts of lead and copper dissolved out of the metallic roofs of buildings, and from foreign matters more or less offen-

*Read before the Kansas City Academy of Science, Oct. 28, 1879.

sive falling thereon and undergoing decomposition. Rain water is also, from its "softness,"—that is, absence of salts and chemical compounds—more liable to undergo fermentative changes than hard water, as well as more ready to form chemical combinations with metals, salts and other substances.

Well and spring waters, which usually contain variable quantities of the compounds of lime, soda, potash, magnesia and alumina, which are required in the economy of the system and which render them "hard," are in consequence of their sparkling and greater thirst-relieving qualities, more agreeable as drinking water than any other; but in cities are not only more liable to contain an excess of these salts, dissolved from the soil in passing through it, but are also far more likely to be contaminated to a highly dangerous degree by sewage, waste of factories, and other filth, which may be present in poisonous amounts without imparting to the water either unpleasant taste or smell, and even without discoloring it in the least.

River water is usually less soft than rain water and more so than well water, the latter condition being caused by the partial and gradual decomposition of its chemical compounds and the consequent deposition or precipitation of their bases. It is also far more largely contaminated by organic substances than either of the kinds of water before named, and is rarely to be found perfectly transparent in color or perfectly attractive to the taste. However, it happens that there are compensations in the case of river water which do not obtain in either of the others, and which result in its purification to a far greater extent than is usually known. Among them are the fishes, frogs and other living creatures and animalculæ which subsist upon the organic matters contained in it, and also the natural products of decay themselves, consequent upon their combination with the oxygen in running waters, such as nitric acid, which is itself antiseptic, carbonic acid, ammonia, etc., which escape from the water into the atmosphere. In addition to this it may be stated that even from the most populous cities the proportion of deleterious matter usually flowing into an adjacent stream, say one-twentieth in volume, is so small as compared with the whole volume of water itself, and is so purified by oxidation and other causes, that an analysis shows an astonishingly small quantity in a given amount of the mixture within a few miles from the source of the contamination.

Perfectly *pure water*, such, for example, as that derived from the melting of snow in the mountains, is believed to lack certain qualities demanded by the human system, and to tend at least to the production of goitre, cretinism and scrofulous diseases of various kinds. Whether this is so or not, it is well established that waters containing moderate proportions of the salts of lime and carbonic acid gas are more agreeable to the taste as well as more conducive to health. Hence, we conclude that in their normal condition it is probable that the waters of wells and springs are preferable for drinking purposes to either of the others.

The consideration of the *deleterious constituents* of the potable waters of cities is a work of no small importance, and requires more time than I shall be able to bestow upon it this evening. But I shall endeavor to be sufficiently comprehen-

sive in my remarks to excite an interest in the subject, which may result in some good to the community.

Cistern waters, as has been remarked, are liable to be contaminated by the gases, vapors and other impurities of the atmosphere, which will be admitted to be by no means inconsiderable when we remember that the vapor arising from the ocean contains common salt and perhaps other mineral constituents in sufficient quantities to render it medicinal miles inland, while over large cities, where numerous manufactures are carried on, the gases arising therefrom modify the lower atmosphere very perceptibly, as is manifested in their discoloring and destructive action upon the materials of which the buildings and other structures are composed. Such mineral ingredients, when found in rain water in a much greater proportion than in ordinary well water, i.e., in the proportion of more than fifty grains to the gallon, are necessarily injurious. But the principal sources of harm are the organic impurities arising from the decomposition of animal and vegetable substances, either washed in from the roofs or accidentally deposited therein, and from organisms floating in the air and precipitated by rain or snow. The former impurities may be filtered out or otherwise removed; but these minute organisms pass through all kinds of filters hitherto devised, and by their rapid propagation become the source of many diseases usually attributed to other causes. It is quite remarkable that some of these poisonous microscopic organisms are only found in closed wells and cisterns, while others are only found in those which are open and exposed to the action of the atmosphere. Among the deleterious organisms found in impure cistern water are Beggiatoa alba, schyzomycetes, the bacteria, monads, vibriones and all organisms free from chlorophyll and promotive of decompo ition of organic matter. Sanitarians differ as to the amount of organic matter, such as nitrates, ammonia, etc., which may be present in potable waters without rendering them unwholesome, but it is safe to say that when such contamination amounts to more than two or three grains of organic and volatile matter to the gallon, or ten to fifteen parts of chlorine in a million parts of water, such water should be condemned as unwholesome. And yet people drink with impunity, for years together, water containing larger proportions of organic matter than these. The answer to this is that "soil as well as seed" is required to produce a crop. The River Pollution Commissioners appointed by the British Parliament class as "suspicious" all stored rain water.

The water of wells is liable to be contaminated in a variety of ways without being affected in appearance, taste or smell, and it is not unusual to find, abounding in wells whose water has been regarded by those using it as especially pure, sweet and wholesome, the elements of the most virulent and deadly blood poisons. These impurities may in part be traced to animal and vegetable substances thrown into the wells from the surface, through carelessness or malice, but the most deadly of them unquestionably come from the leachings of sewers, stables and cesspools in their immediate vicinity. Public wells in crowded localities, and where horses and other animals are watered are most liable to such contamination.

I have in my possession the reports of a number of the Boards of Health of various cities in different parts of the country, North, South, East and West, and the unanimous verdict of them all is that most of the well water in cities is more or less contaminated by these means, and that in by far the greatest number of cases the outbreaks of typhoid fever, diphtheria and other zymotic diseases are due to the admission into the system of poisonous organisms by drinking well water impregnated with filth filtered through the ground in this way. The investigations of the British Health Commissioners elicited the fact that scarcely a well could be found in any of the beautiful, charming towns of England that was not an absolute source of disease to those using its waters, and that the older the town the more certain they were to find its waters thus contaminated and its death rate higher than in the newer localities. The researches of sanitary commissions in this country prove the same thing, and the reports from Providence, R. I., Rochester, N. Y., Dayton, Ohio, St. Paul, Minn. and Denver, Colo., all concur with the greatest unanimity in attributing the epidemics of typhoid fever, diphtheria, etc., which have scourged them respectively, to the same cause. In London an other disease has recently made its appearance in crowded districts, which is regarded as a new form of Cyprus fever, and chargeable to impure water.

The nature of the soil upon which a town, or any portion of it is built, has much to do with its healthfulness in the matter of well water. For instance: it is easy to see that a loose, porous or sandy soil is more readily permeated by fluids of all kinds whether deleterious or not, than a dense, compact and tenacious soil, and that the former is less likely to prove an efficacious filter than the latter. It is impossible to lay too great a stress upon this subject, and yet time will not admit of further discussion of it. In view of the fact that as a rule people are more fatally attached to their favorite wells than to any other of nature's gifts to them, it may be stated that some analyses made by the celebrated Dr. Frankland of well waters in England noted, famous, for their sweetness of taste, sparkling brilliancy of appearance, and supposed dietetic wholesomeness, revealed the fact that so great was the amount of organic impurity present that the water was actually worth in the market two dollars per ton as manure.

While such a degree of filth contamination may not exist in many localities in this country, still revelations have been made by laborers, in excavating for cellars and foundations of buildings, even in some of the cities of the West, which have too clearly pointed out almost equally disgusting and alarming conditions.

The British Commission before referred to classed as "dangerous" the water of all shallow wells. Prof. Phipson regards the presence of phosphoric acid in well and river waters as undoubtedly a bad sign; and Dr. Frankland concludes that the development of fungoid germs cannot take place without the presence of phosphoric acid, or a phosphate, or phosphorus in some form of combination, and that water, however much contaminated, if free from phosphorus, does not produce them. Hence, we have this, in addition to other poisons, to look out for in our investigations of drinking water.

The deleterious qualities of *river water* are derived both from the decomposition of animal and vegetable matters and also from the putrescent and putrescible substances carried into it by springs and brooks, sewers, drains from factories, etc., and consist of organisms similar to those described as existing in rain and well waters. To show to what extent the water of rivers is contaminated in passing by or through large cities it has been found by analysis that the Seine nearly doubles its proportion of mineral ingredients in passing through Paris, while its impregnation with organic matter is also largely increased. The river Thames receives so much organic matter from the sewers, factories, etc., of London as to render its waters below the city highly offensive, though above it its water is excellent in quality. Dr. Phipson analysed some water taken from the river Dart, which was so contaminated by sewage and refuse from chemical works that it poisoned and killed the fish. As above remarked, however, much of the impurity thrown into running streams is oxidized and rendered harmless within a few miles below the source of contamination.

Organic matters are largely present in all river waters, some of which are harmless even in large quantities, while the presence of others, such as putrid organic matter, numerous bacteria and micrococcus and minute white fungoid growths are, according to the best authorities, sources of imminent danger. The presence of nitrous acid is also to be regarded as a very serious matter. The British commission already referred to classed as "dangerous" all river water to which sewage gains access. It may here be remarked that much of the organic and coloring matter found in river water is due to living green algæ and the products of the decay of leaves and other vegetable substances, which are comparatively harmless.

Thus it appears that each of these kinds of water is injuriously contaminated by the air or soil of cities to a degree and with a class of poisonsa lmost impossible in the country, and that the water of wells in cities is to be regarded with most suspicion.

Resuming the subject of potable waters in general, we take up the consideration of the micro-organisms, heretofore spoken of, as regards their deleterious action upon the human system. Professor Barnard in speaking of them says in substance: The Infusorians, whose unaccountable readiness to spring up wherever decaying organic matter existed, first suggested their name, are found chiefly in fresh water lakes, rivers, and smaller streams, where they multiply in myriads and are constantly swept about by the current. "It is commonly thought that pure drinking water is filled with these microscopic creatures and it is sometimes said that they constitute the life of the water. All this is the opposite of the facts. Pure water is not inhabited by organisms; on the contrary, stagnant or impure water alone affords them subsistence. They hasten the destruction of the dead animal and vegetable matters the waters may contain, causing for the time being an infusion or fermentation of the liquid in question." "While their devouring work is a 'bottling up' of injurious and infectious matters, thus purifying our

world, the substance their little bodies may contain and their parasitic action, when inoculated into the bodies of higher living organisms by contact, inhalation, eating, drinking, &c., render some kinds extremely dangerous as conveyers of the various contagious diseases."

It has long been taught by Prof. Austin Flint and others that the source of typhoid fever is a specific poison propagated through the alvine evacuations by contamination of the drinking water and atmosphere. The Boards of Health of Providence, Rochester, Baltimore, Cleveland, Dayton, Toledo, Minneapolis, Milwaukee, Denver and Savannah, now in my possession, and in fact, all medical authorities, agree that such is the case, and that as our cities grow older their citizens go on storing up elements of destruction which nowadays only develop here and there cases of typhoid fever, diphtheria and other dreaded diseases, but which, when the soil becomes impregnated beyond its capacity of neutralizing the poison and imparts it unchanged to the air and drinking water, will produce just such horrible epidemics as have been known in the crowded cities of Europe and the East.

They also agree that most of these diseases have their origin in living organisms that chemistry would wholly fail to discover. Dr. O. W. Wight, of Milwaukee, states the case thus: "A few spores, invisible to the naked eye, of some deleterious cryptogam may enter the stomach with the drink and there take root and increase into a growth of fatal disease. The ova of microscopic animalcules, or animalcules already full grown, may enter the system with drinking water and feed upon us till we die." Prof. Tyndall tells us that the spores of the *bacillus anthracis* killed nearly a thousand human beings and more than 50,000 animals in five years in the provinces of Norgorod. Dr. Detmers, of Illinois, discovered in his investigations of hog fever, or cholera, a new order of bacteria or bacillus which he believed to be the true seeds of this fatal disorder. This bacillus he determined by observation and experiment to be conveyed from one animal to another by means both of the air and the drinking water, which latter means of communication was conclusively shown by the fact that the course or progress of the contagion was down the stream in every instance, rather than the reverse.

It is apparent to all that the nature of the soil and the relative positions of the contaminating source and the well or stream, govern to a great extent the proximity that may be allowed between such objects. Shallow wells as a rule are more impure than deep ones. Wells, whose water comes from the surface of the first stratification of rock reached in digging, are naturally affected by whatever impurity gravitates into them. Wells in level ground without rock will drain a greater or less area, according as the soil is porous or not. Dr. A. N. Bell says that "the drainage of such a well extends from two to five feet in every direction for every foot in depth. Hence a well in compact soil, twenty feet deep will drain a circumference eighty feet in diameter; in a porous soil a well of the same depth will drain a circumference two hundred feet in diameter, the well being in the center."

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It is generally believed that in passing or percolating through soils, especially those which are porous or sandy, the impurities of the foulest waters are removed, but such is far from being the case with the micro-organisms and subtle poisons resulting from putrefactive decomposition. These no filter can remove. This is clearly shown by the results of the chemical analysis of certain wells in the typhoid fever sections of Rochester, New York, by Prof. Lattimore. The soil underlying that city varies in density, but in all cases the water taken from these wells was clear, cool, sparkling, and contained no bad taste or odor, so that it might be regarded as thoroughly filtered, yet the analysis showed an average of 16.78 grains of common salt and large proportions of free ammonia and albuminoid ammonia; thus disclosing beyond any question the disgusting origin of the water, or at least of its eontaminating qualities.

I am indebted to Mr. Wm. Paul Gerhard, civil engineer connected with the water works of St. Louis, for the following results of sanitary analyses of well waters in different localities in that city made by him in 1878–9, as well as for for much other very valuable matter, to be used hereafter.

Location of Well.	CHLORINE. Grains per Gal.	HARDNESS.	ORGANIC MATTER.	REMARKS.
Franklin av. 2406	20	—	Traces:free am'a large am't	——
Broadway, 2123	11.8	31°	Marked	——
Franklin av. 2320	4.5	35°	Traces	——
Franklin av. 2400	20	46°	Traces	Total solids:
Carroll Street .	28	—	——	125 grs. gal.
Fr'n av. cor 16th	16.5	—	——	——
Carroll Street .	32	—	——	——
(?)	16	—	Present: large amount of sulphuretted hydrogen.	——
(?)	22.5	—	——	——
14th St., No. 12	11.5	—	Organic Matter present	——

Prof. Paul Schweitzer, chemist of the Misiouri State University, at Columbia, Missouri, kindly furnishes the following results of analyses of well waters in that place:

LOCATION.	Grains inorganic matter per gallon.	Grains organic matter per gallon.	100 c. c. water requires c. c. permanganate of potash.
Rock Spring, University farm . .	21.2036	None	1.5
Mr. Loeb	27.9757	Trace	3.0
Mr. Batterton	66.1723	Trace	2.5
Prof. Ficklin	38.3573	Trace	2.5
Mr. Scruggs	36.2542	Trace	1.5

These two analyses show in a marked degree the difference in the amount of organic impurities in city and country wells.

Having thus examined the whole subject in a general way, the conclusions arrived at are that in cities fresh rain water, when obtained with proper precautions is the purest drinking water, river water next, and well water the most likely to be contaminated by dangerous substances and the most liable of all to deceive

consumers; but that all of them usually contain greater or less amounts of deleterious ingredients, and that some of them are disgustingly foul and unwholesome.

I may here pause to say that I have been favored with a few analyses of the well, cistern and hydrant water of this city by Prof. Patrick, of the Kansas University, and I am happy to say that he closes his statement of results with this remark: "From this examination it seems that the supply of Kansas City, except where contaminated by local impurities, is excellent." The water furnished him for examination was taken respectively from the hydrant in the Post Office, a cistern in the rear of Mr. S. K. Green's store, on Main street, and the public well on the corner of Fifteenth and Grand Avenue. The hydrant water is of course of the same quality all over the city, but we all see wells and cisterns every day which are so located that they can hardly be anything but certain receptacles for all manner of foul and filthy matter both from the surface of the ground and from drainage below the surface from sewers, cesspools, etc. And the experience of our own physicians, as well as those already referred to, is that the water from such sources is the cause, or if not the direct cause, then the efficient and prolific propagator of the virulent poisons so often heretofore referred to.

The question then next arises, what remedy can be applied to prevent the contamination of water in cities and by what means can such water be purified and rendered wholesome?

Of course nothing can prevent the contamination of water except the rigid enforcement, by state and municipal authorities, of the strictest sanitary measures regarding the cleansing of wells, vaults and cisterns, and the avoidance of draining sewage into lakes or rivers near the point of water supply. As these measures will probably not be carried out perfectly very soon, we may turn to the second remedy.

For the separation of ordinary impurities, numerous filters and precipitants have been suggested, of which I will name a few of the best.

1. A quantity of scrap iron placed in the water will most effectually remove organic matter, but the water must be subsequently passed through a bed of gravel and sand to separate all the oxide of iron which is formed.

2. Prof. Bischof, of Glasgow, proposes filtering the water through spongy iron and powdered limestone. The iron having been reduced from the ore, without fusion, to a powdery, spongy state, is placed in the upper portion of the filter and the limestone in the lower part. The iron removes all albuminoid and nitrogenized compounds and the limestone separates any trace of iron imparted to the water.

3. Major Crease, of the English navy, objects to the use of spongy iron and of animal charcoal, as media for filtering water for troops on the march, that the water passes through them too slowly, and recommends in lieu of both a filter composed of a newly devised carbonized material called carferal, which combines carbon, iron, and silicate of alumina and has been experimented upon and approved by analytical chemists; the result of their examination being the conclu-

sion that it is somewhat less costly than animal charcoal, is not injured by damp as spongy iron is, and does not require the water to be passed through a second medium.

4. Dr. L Lewin considers animal charcoal by far the best filtering material, for the reason that it not only holds back coloring matters and decomposes or partially retains most mineral, salts and gases, but it absorbs and detains the most varied organic compounds, nitrogenous as well as non-nitrogenous; its only drawback being its ready saturation with arrested impurities, so that it requires to be frequently renewed or revived.

Of precipitants, several have been proposed, and, as it is from these that in my judgment we have most to hope and expect, I will devote a few moments to their consideration.

1. Prof. Wm. Crookes suggested, in an article on the purification of water for the use of the soldiers in Africa, that the only substance that is practically available is sulphate of alumina, or common alum, as it has the power of converting all organized animal matter, living germs, &c., into an insoluble substance like leather, and probably of destroying their vitality; at any rate permitting the precipitate to be filtered out. This precipitation is much expedited by the addition of fine clay to the alumnia.

2. A mixture of alumina, clay and charcoal is used in England by the Native Guano Company, for the purification of sewage, with such success that the most offensive and foul smelling liquid is in a quarter of an hour converted into a bright, clear, inodorous, tasteless water, non-putrescible, and so pure as to allow the most delicate fish to live in it.

3. Prof. Crookes suggests another precipitant, consisting of one part of permanganate of lime, ten parts of sulphate of alumina and thirty parts of fine clay. This when added to London sewage in the proportion of twenty parts to the ten thousand purifies it completely in a short time. Foul ditch water can be purified with a much less quantity.

M. Jean de Mollins, who has dealt with the waste waters from the woolen mills of Raubaix, recommends milk of lime and sulphate of alumina, together or separately. He considers that the action of the aluminous hydrate upon the organic impurities of water is quite analogous to its behavior with dissolved coloring matters, which it throws down in the form of lakes. He also points out that clay, if diffused in water, becomes coagulated by the presence of certain salts and carries the organic impurities down with it. Many of our older citizens will remember the practice which prevailed in the days when we drank Missouri River water almost exclusively, in this city, of precipitating the impurities by means of pounded almonds thrown into it. Professor Tudesco says that "the organic cell, in contact with aluminous compounds, absorbs alumina with great avidity, losing its vegetative power and putting an end to the process of decomposition."

The most certain and destructive to organic life of all the antiseptics seems to be chlorine or some of its compounds. Prof. Ogden Doremus, of New York,

asserts that "chlorine gas, especially with the aid of moisture, which facilitates its action, can dehydrogenate (and thus destroy) any of the virulent spirits which result from vegetable and animal decomposition." Among the compounds of chlorine that are most likely to be harmless to the human system and at the same time effectual in destroying organic impurities in drinking waters, is hydrochloric acid, one of the most important factors in digestion, and a substance which possesses all the desired antiseptic qualities. To what extent it can be used in this direction remains to be ascertained by further experiment. So far, we know that a very small proportion of this acid (say 0.5 per cent) will prevent putrefaction, and that twelve drops to the ounce of water will speedily dissolve nitrogenous substances. This suggests the use of hydrochloric acid to aid the gastric juice in destroying organic germs in low forms of zymotic disease, where the digestive powers are greatly reduced, and thus preventing their escape from the body in an infectious condition.

Much might be added in the way of application, but enough has been said to draw the attention of those who have any regard for the health of themselves or their fellow citizens to the overwhelming importance of demanding from the authorities the enforcement of a system of sanitary rules and regulations which shall insure the absence from the cisterns, wells and reservoirs of the city, of the disgusting and poisonous organisms which have been mentioned, and in this way prevent the occurrence of sorrow-laden epidemics in our midst.

ASTRONOMY.

THE PLANET JUPITER.

WM. DAWSON, SPICELAND, INDIANA.

Jupiter is now a bright and evening star, seen easily in the southeast, half an hour before dark—a beautiful diamond star in the south at 8 o'clock. Its brightness is decreasing slowly, and will be least conspicuous in March, 1880. This is the largest member of our planetary family, being no less than 85,000 miles in diameter, and nearly 500,000,000 miles from the sun. When in opposition, i. e., on the opposite side of the earth from the sun, as was the case two months ago, it is about 200,000,000 miles nearer to us than when near its conjunction on the other side of the earth. And this makes quite a difference in its apparent size and in the visibility of its moons, or satellites, of which there are four. The contents, or actual size, of globes being to each other as the cubes of their diameters, a very little calculation shows that Jupiter is about 1,300 times larger than our own world; for the earth is 7,912 miles in diameter, and Jupiter nearly eleven times as much, and the cube of 11 is 1,331.

XUM

Moving around the sun at the rate of 30,000 miles an hour, it takes 11 years 315 days—fifty days less than twelve years—for this planet to complete its annual revolution around the sun—its own year. It rotates on its axis in 9 hours 55 minutes and about 30 seconds, making its day nearly ten hours long. Hence, Jupiter's year consists of 10,477 of its own days. The days and nights up there are equal, or nearly so, over every part of the planet throughout the year, the axis of Jupiter being about perpendicular to the plane of its orbit. The seasons also, are forever alike in the same part of the planet, being perpetual summer at the equator and everlasting winter at the poles. The great distance from the sun at which Jupiter is located would make the solar heat there twenty-seven times less than it is here. Yet a wise combination of the elements of air, clouds, etc., has, doubtless, adapted the climate of that country to the comfort and well-being of inhabitants who may dwell in that far off region of the universe. The rapid whirl of Jupiter on its axis causes a protuberance of the equatorial regions, making that diameter 5,000 miles longer than the polar diameter.

Although Jove, (another name for Jupiter,) is 1,300 times larger than the earth, yet he is much lighter in proportion to size, being only one-fourth as heavy, bulk for bulk. Then his actual weight, or mass, is about 312 times that of the earth; and, making allowance for his size and mass, it is calculated that the force of gravity, or weight of a body, on this planet is nearly two and one-half times as great as it is here. Hence, a moderate-sized man there would weigh more than 300 pounds.

A magnifying power of fifty, or even thirty, nearly always shows the appearance of one or two belts or dark bands across the planet. They are parallel with the Jovian equator and nearly parallel with the ecliptic (the earth's orbit). A considerable increase of telescopic power shows two or more belts quite distinctly. Sometimes they are connected at intervals by cross-bands and patches, thus giving the appearance of fringy, light spots along between the belts. These phenomena were conspicuous on the night of October 25th, 1879. High magnifying powers bring out a variety of detail, in which are found several belts and many forms of cloud-like appearances, some of a stratified arrangement and others of large and small patches of different shapes. The great forces at work there sometimes produce changes so extensive as to be easily perceived in twenty-four hours, or even less. Indeed, it is said that a large belt has been observed to vanish in two hours, and another to form equally suddenly. The cause of these belts has been referred to clouds thrown into parallel bands by the rapid whirl of the planet on its axis; or, perhaps more correctly, they are belt portions of the body of Jupiter seen between extensive masses of clouds which envelop a great portion of the Jovian surface. Professor Newcomb says: "From the changeability of the belts, and indeed of nearly all the visible features on the surface of Jupiter, it is clear that what we see on that planet is not the surface of a solid nucleus, but vaporous or cloud-like formations which cover the entire surface and extend to a great depth below. To all appearance, the planet is covered with a

deep and dense atmosphere, through which light cannot penetrate on account of thick masses of clouds and vapor." The professor's closing sentence gives a rather dark idea in reference to light on the immediate surface of Jupiter. However, he advances the doctrine that this planet is slightly self-luminous. He and Proctor both maintain the idea that great heat prevails on this planet. Let clouds and fire, and air and water, be as they may, I feel sure that the Creator has furnished this great body of the solar system for a beneficent purpose in the economy of creation.

Now for

THE NEW SPOT ON JOVE

which has been attracting so much attention for a month or two. My first special observation of it was on September 14th, when it appeared to be one-fifth as long as the diameter of the planet, and one-fourth as wide as long. It seemed nearly square, or straight across the ends, and of a darkish fine copper color. In two weeks the ends were extended in blunt points giving an elongated oval appearance. I do not observe any change since, unless it be an increase of length, which seems apparent. I agree with a writer in the *English Mechanic*, that "if this spot should eventually encircle the planet and become permanent, it would greatly add to its beauty." I estimate the area of this wonderful spot at about 100,000,000 square miles. It is not visible at the same time each night on account of the planet's rotation, being four hours earlier or six hours later every night. Professor C. W. Pritchett, of Glasgow, Missouri, has observed this spot quite a number of times since July 2nd, with a telescope twelve inches aperture having a fine micrometer and apparatus for accurate work. He locates the spot as in the 251st meridian and forty degrees south-latitude. He also reports it to be fourteen and one-half seconds long and four seconds wide. This would give an area considerably greater than that of my own estimate, but then I wanted to be within bounds, especially as it was partly guess-work at best. The color he calls rose-tinted, and says it is plainly visible in daylight, even when the sun is up. A spot similar to this, and believed to be the same one, was seen by Professor P. about the middle of last year. And, although he afterward looked at the planet many times, and very carefully, yet he failed to see the spot again for nearly a year.

But E. L. Trouvelot, of Cambridge, Mass., on September 25th, 1878, observed a spot of about the same size and color as the one observed by Mr. P. July 9th, 1878. And, to make the matter of sudden change more conspicuous, Prof. T. made a good observation and drawing of this same region of Jupiter, without seeing any trace of the spot, on September 20th,—only five days before the full appearance of that great country, which is more than five times the size of our whole American continent, and yet appears to us only as a clever-sized spot, and magnified 10,000 times at that. And if, as some suppose, this extensive territory should be a continuous mass of flame, or a deep gulf of burning gas, with what awful interest may we contemplate the wonderful works and power of God.

XUM

F. S. Davenport, of Jerseyville, Ill., had for some time been watching Jupiter carefully with a four inch telescope for "something new," and at 9:30 p. m., August 25, 1879, saw the new spot, appearing of a "decided pink color," and one-fifth as long as the planet's diameter, and one-fourth as wide as long—corresponding in size with my own estimate.

From several observations by different persons, it would seem that this spot has wholly disappeared from the face of Jupiter, and then reappeared, two or three times, within two years past. And observations in past ages indicate the formation and disappearance of large spots, as well as sudden changes in the belts, In 1664 a large spot appeared, by which Cassini and Hook discovered that Jupiter turned on its axis in 9 hours and 56 minutes. This spot seemed to vanish and reappear eight times between 1665 and 1708. In the years 1785–87, Schroeter observed extensive changes on the Jovian disk. Others again were conspicuous in 1835. Next to the sun Jupiter presents to our view more appearance of stormy commotion than we find on any other heavenly body.

But the crowning glory of Jupiter is the fine retinue of moons which are always moving round and round the parent orb, displaying their faces first one side and then the other of the great Jovian disk. These fine stars were discovered by Galileo soon after his invention of the telescope. But they were not described in the writings of Aristotle, and those people who believed that everything in nature was described by the old philosopher, discredited Galileo's announcement. One of them said "to see the satellites of Jupiter one must have a telescope that would produce them," but allowed his mind to change when he looked through the glass and saw them. Another savant with more caution would not look lest he should spy them and be convinced. He died soon after, and Galileo said in his witty, caustic style: "I hope he saw them while on his way to heaven."

One or two records exist showing that these delicate bodies have been seen with the naked eye. But such cases are very uncommon. However, a small spy-glass will show them, especially when in opposition to the sun. A telescope 1½ to 2 inches in diameter shows them as beautiful stars. And a view through a large telescope of Jupiter, with his belts and four satellites all in a row, is one of the most interesting sights that we find among the heavenly bodies. The orbits of these moons are all nearly in the plane of Jove's equater, which is nearly in the plane of our ecliptic; hence at every revolution they pass along this side the planet, and then are hid on the other side, excepting that the one farthest away, called the fourth satellite, sometimes passes a little to the north or to the south of the planet without being hid. The passage of a satellite over the face this side is called a transit; on the other side an occultation, and through the shadow of Jupiter an eclipse. This is generally to one side, east or west, of the planet. It is an interesting operation to watch one of these little diamonds pass into the shadow, appearing as though it were blotted out of existence, then reappear in two or three hours, continue visible for a few minutes (sometimes only one minute), then

disappear behind the planet, and finally show itself at the other side, ready for another round of unceasing travel. And these rounds are so precisely regular that they are computed and published several years in advance, giving the exact moment of the several transits, eclipses and occultations, and also of the moon's shadow on the planet, which often lingers behind the moon itself. The satellite, being about the same color and appearance as the planet, is rarely seen in transit, But the black shadow is prominent, and may be followed along near the belts with interest. Eclipses of these moons afford ready means of ascertaining our longitude, at least approximately. I find they occur about thirty-four minutes earlier at Spiceland than at Washington. Hence my longitude is about 8° 25′ west of our first meridian. In 1675 Roemer, of Denmark, discovered the means of ascertaining the velocity of light by these eclipses. As mentioned above the times at which they take place are computed beforehand. Now observation shows that they occur 16 minutes and 36 seconds later when Jupiter is farthest from the earth than when he is nearest—showing conclusively that this time (996 seconds) is required for light to pass across the earth's orbit, 184,000,000 miles, and this divided by 996 gives 185,000 miles for the velocity of light per second. Again I have often made time observations on these bright little orbs, by which to regulate my clock In fact, the system of Jupiter with the oscillations of its moons from one side of the planet to the other, makes a grand time piece hung up in the heavens, keeping time for several worlds.

The names of the Jovian satellites are first, second, third and fourth, in the order of distance from the primary—first being nearest, and so on. The size of these "diamonds in the sky" is not far from that of our moon, the first and second being very near, while the third and fourth are some larger. And satellite first is about as far from its primary as our moon is from its primary—240,000 miles; but the great mass and consequent strong attraction of Jupiter causes it to revolve around the primary in one day and three quarters, equal to forty-two hours, or about four days and a quarter of Jovian time, which is the real lunar month of this moon. Satellite second revolves in twice the time of the first, and at about double the distance. The third satellite requires a week to make its monthly round—700,000 miles from its center of motion, while the fourth occupies near seventeen days at a distance of 1,250,000 in making a month of forty-one Jovian days.

These satellites, like our own moon, are believed to rotate on their axes in the same time that they revolve around the primary—thus always presenting the same side to the parent orb.

There exists a curious relation to each other of the motions of the first, second and third satellites by which they never can be all together at the same time; and hence never all eclipsed, nor in transit at once; and yet all four are sometimes invisible to us. Some may be on this side, some on the other side, and one or two eclipsed in the shadow of Jupiter.

The interest we feel in a coming eclipse of the sun or moon is well known,

particularly if it be nearly or quite total. Now let us imagine that we have four moons, the farthest and slowest of which makes an eclipse of the sun and is itself eclipsed every seventeen days, with occasional exceptions of longer periods. This would give about twenty eclipses of the sun and twenty of the moon in a year. The third or next nearer satellite would give a total eclipse of the sun and one of the moon every week, fifty-two of each in one year. The second satellite makes two hundred total eclipses in a year, half of them solar and half lunar. And the first satellite two hundred of the sun and two hundred of the moon. Then how many Jovian eclipses, think you occur annually? I calculate that a total eclipse of the sun and one of the moon occur there every day in the year on an average —but never two days without, and occasionally two in the same day. I have never till now made this calculation, nor seen it from any one else. If the numbers are too great, some one set me right.

Now that two eclipses occur every day, four moons are rapidly changing their places and phases, and all the brilliant stars that we see decorate their nightly skies, what scenes of true magnificence do the Jovites behold. Surely they might agree with David of old: "The heavens declare the glory of God, and the firmament showeth his handiwork"

The night there being only five hours long—from sunset to sunrise, and dark perhaps four hours—our people would hardly be satisfied with the time allotted for sleep. But again, it is as easy for the Creator to adapt the people to surrounding circumstances as it is to make a world.

THE LICK OBSERVATORY OF THE UNIVERSITY OF CALIFORNIA.

VISIT OF PROFESSOR S. W. BURNHAM.

It is now more than five years since James Lick, a millionaire of San Francisco, placed in the hands of certain trustees the magnificent sum of $700,000 for the purpose of erecting and equipping an observatory on the Pacific coast, which was to constitute the Lick Astronomical Department of the University of California.

As is usual in such cases, much trouble has ensued and nothing has been accomplished, so far; but the following extracts from the San Francisco *Chronicle*, of October 18, indicates that at last the trustees of this fund have concluded to commence operations:

The visit of Professor S. W. Burnham to this coast has determined, beyond any reasonable doubt, that Mount Hamilton, in Santa Clara county, will be the future site of the finest astronomical and meteorological station in the world. The site originally chosen for the observatory was at Lake Tahoe. Before making the second deed of trust, however, circumstances induced Mr. Lick to change his opinion of the advantages of the proposed site, and a series of experimental surveys were made, with a view of obtaining the best location within an easily ac-

cessible radius of San Francisco. The first place visited was Mount St. Helena, at the intersection of Napa, Sonoma and Lake counties. This mountain is 4,343 feet high, and has many of the atmospheric conditions essential to a successful observatory site. Mr. Lick was at first greatly pleased with Saint Helena, visited it in person and spent one night on its summit. Among other points visited was Mount Hamilton, thirteen and three-quarter miles in an air line east by south from San Jose. Upon learning that the highest peak of Mount Hamilton was considerably higher than the highest point of Saint Helena, while in other conditions, so far as known, the Santa Clara county eminence was fully equal to its less accessible rival, Mr. Lick determined upon Mount Hamilton as the final location of his most cherished scheme.

With James Lick decision and action were simultaneous. He immediately opened negotiations with the county of Santa Clara for the building of a road to the summit of Mount Hamilton. From Congress Mr. Lick obtained for observatory purposes two sections of government land; 175 acres were located with university scrip, and the donor purchased privately eighty acres of woodland. Of the 1,535 acres thus set aside for observatory use, only a small portion is essential to the immediate needs of the projected buildings, but the residue will be utilized for pasture and for fuel and water supply. The steep and broken character of the ground renders a large surface of land necessary for the adequate protection of the observatory against fire and from miscellaneous intrusion.

October 1, two years ago, James Lick died, after a lingering illness of nearly four years. Shortly before the death of Mr. Lick, Prof. Simon Newcomb, then resident astronomer in the Naval Observatory at Washington, was invited to this coast to carry out a series of test experiments on Mount Hamilton. Prior engagements made it impossible for Prof. Newcomb to close at once with the proposition of the Lick trustees, and his subsequent acceptance of the responsible and onerous charge of directing the "Nautical Almanac" put it out of his power to undertake a work for which he was eminently qualified. But, though he could not come himself, Prof. Newcomb was of lasting service to the trustees in suggesting the name of Prof. S. W. Burnham, of Chicago, with whom final negotiations were made last April.

Formerly a lawyer, and earlier a short-hand reporter, Prof. Burnham began about ten years ago to turn his active attention to practical astronomy. Being the possessor of a competence, he was enabled to carry on his researches independently, and for all his scientific labors, some of them of pre-eminent value, he has not received a single dollar either directly or indirectly. Beginning in the most quiet way, the young scientist made himself almost instantly a power in the world of science. His specialty has been and is "double stars." With an instrument of his own, a six-inch Alvan Clark refractor, he has discovered over 1,000 double stars, all of which he has catalogued, and the sum total of his labors in that single direction places him at the head of living discoverers.

Contrary to general belief, the visit of Prof. Burnham to Mount Hamilton

was not for the purpose of determining or assisting to determine the site of the observatory. That had been already determined, but the question of the size and character of the telescope to be employed was the objective point of his experiments. The language of the donor of the observatory provided that the telescope purchased should be the best in the world. At this day "best" means a good deal. Twenty years ago it did not mean so much.

Prof. Burnham arrived at Mount Hamilton August 17, and went at once to work. He brought with him his own six-inch telescope, with the necessary equatorial mountings, and a temporary observatory was at once erected. In shape, this temporary structure is a duplex-octagonal, with a dome-shaped roof, in which a narrow slit, a quadrant in length and about fourteen inches wide, leaves ample scope for the object-glass of the telescope. The dome is formed of bent gas-pipe covered with canvas, and rotates on iron balls, so as to allow the glass to cover every portion of the visible heavens. The building is about twenty feet in diameter, the sides being put together in movable panel sections. The observatory was made in San Jose, and is an extremely creditable piece of work. In the exact center is the telescope mounted upon a brick pillar capped with a granite block. The telescope is, as has been stated, the personal property of Prof. Burnham, and was manufactured for him some eight years ago by Alvan Clark, of Cambridgeport, Massachusetts, the most successful of all makers of refracting telescopes. The telescope is equatorially mounted on the true meridian. Its motion in following a given star is regulated in conformity with the velocity of the earth, or, in other words, the place of the star under examination is fixed. This end is attained by means of a driving clock regulated by the latest improved governor. This governor is a variety of the conical pendulum which vibrates in a circle and is brought back to a definite speed by a cylindrical brake. Almost every combination of mechanical force is brought into play in moving and adjusting the telescope, and the perfection of scientific mechanism is so nearly attained therein that there is almost no margin at all for improvement.

In order to determine the atmospheric conditions of the site, Prof. Burnham examined a great number of test objects. He has observed and measured a great number of double stars, has discovered about twenty new doubles, and has made day-time and night observations of a great number of prominent "naked eye" stars. He has also experimented with cutting down the telescope aperture, and has made many other experiments, all of which tend to confirm his opinion that Mount Hamilton is one of the best astronomical sites in the United States. Besides the freedom of the Mount Hamilton atmosphere from fogs and other astronomical difficulties and bugbears, there are facilities for seeing objects near to the horizon which do not exist in any station at present located in this country. According to Prof. Whitney, there is a broader sweep of horizon visible from Mount Hamilton than from any other portion of the State. Although the difference in latitude is not material, objects can be located several degrees further south than from the prominent Eastern observatories.

Up to the 27th of last month, Prof. Burnham had spent thirty-two nights on the mountain, and during this time all but five nights had been extremely favorable for observation. Although practically out of the Coast Range fog belt, an occasional gale blows the mist across the Santa Clara valley from two points—Monterey Bay and the Sandhill Gap, just south of the city. On extraordinary occasions this fog reaches the crest of Mount Hamilton, but ordinarily the sky is cloudless all summer, while in the East the average of clear nights is less than three per week.

The visit of Prof. Newcomb to the observatory, about two weeks since, was so highly satisfactory to him that he told the trustees he believed Mount Hamilton was the finest observatory location in the United States. The favorable opinion of Profs. Burnham and Newcomb is shared by Prof. Soule, of the State University. The practical results of the labors of Prof. Burnham, and the confirmatory opinions of his associate scientists, have made the course of the trustees straightforward and easy.

The next thing in order is "to order." There is plenty of margin for securing the very best work, as a glass of the projected size and quality will require fully three years in construction. Alvan Clark & Son have recently entered into contract with the younger Struve, of the Imperial Observatory at St. Petersburg, to furnish the object-glass of a 30-inch refractor at a cost of $32,000. The largest refracting telescope now in use is located in the Washington Naval Observotory, its object-glass being 26 inches in diameter. The exact size of the Lick Observatory telescope has not been determined, and will depend somewhat upon the success of the Struve glass. In order to properly observe the transit of Venus in 1882, the trustees purpose to secure at once a twelve-inch refractor, which will become a permanent fixture of the observatory.

The buildings necessary to the complete equipment of the observatory are as follows, though of course no definite plan has been decided upon: The observatory proper, which will consist of a single building, exteriorly connected with which will be a library, study, computing room and a sleeping room. As essential adjuncts to the chief observatory buildings will be a house for the astronomer in charge, another for his assistants, stables and various outbuildings, and a large building for the accommodation of the general public, which last building will doubtless be rented as a hotel.

The formation of the summit of Mount Hamilton is trap rock and porphyry, with croppings of a metamorphic slate lifted by later upheavals.

At the summit of Observatory Peak a space 120 x 260 feet will be graded to a depth of 25 feet. This will afford ample room for the observatory buildings proper, and the other buildings can be placed to advantage on a shelf of the hill lower down. The main observatory building will be about 70 feet in diameter. The foundation will be stone and brick, the walls iron and steel. The walls will be thirty feet high and the dome thirty feet additional. In addition to the large telescope and its smaller companions, there will be an equatorial, a meridian cir-

cle, and such other supplemental and accessory instruments as may be found useful.

During Prof. Burnham's sojourn on Mount Hamilton he has had the use of a number of meteorological instruments furnished by the War Department, and the result of his experiments has proved the excellence of the location as a future meteorological station.

There remains much to be done before the design of the lavish donor can be realized; but the trustees have their work well in hand, and it is more than likely that next year will see an active prosecution of the work.

METEOROLOGY.

SCIENTIFIC VIEW OF THE INDIAN SUMMER.

The delicious season popularly called "Indian summer," usually appears about the first of November in this latitude, and none of us need to be reminded of the enjoyable character of that exquisite part of the cycle of the season, or of that admirable balance of the terrestrial forces which bring to this region this genial portion of the year. Climatologists tell us that the area of its geographical extent not only covers the northern parts of the United States and Canada, but also of the far northwest.

It is certainly a very characteristic and periodical phenomenon in all these high American latitudes, as it is in Central Europe, though probably in a less marked degree; and there are reasons for believing that it exerts its softening influences up to the Arctic circle, tempering the first waves of winter cold that descend upon Arctic America. But it does not appear to lavish its charms on the far South or lower latitutes of the United States, where, indeed, they are not much needed. Although it is often prolonged into December, when a calm, hazy atmosphere fills the sky, through which the sun, shorn of its strength, sinks day after day, like a globe of fire, the Indian summer, at the Provincial Observatory, in Toronto, Canada, has been occasionally recorded as early as the 6th of October. The average date of its distinct appearance there, deduced from fourteen years' observation, is October 27.

Search for an explanation of this phenomenon has not escaped scientific investigation. As either pole of the earth is turned around the sun after the vernal equinox, and solar effect increases in the direction of that pole until a thaw of the winter's accumulated ice sets in, then an interval of cold occurs, caused by the rapid absorption of solar heat, and thus the frequent "cold spells" of the later spring months are accounted for. When, on the contrary, either pole is turned away from the sun after the autumnal equinox, the converse process takes place;

the higher parts of the continent are chilled, and the ensuing condensation of the vapor in the air liberating its heat, raises the temperature, and thus an interval of comparatively warm weather or "second summer" follows.

This simple explanation of Indian summer, first advanced by Admiral Fitzroy, is corroborated by the fact that the increase of temperature attending it is the greatest in the highest latitudes of America, where it is described as sometimes "oppressive"—just where, of course, the earth's crust in October is undergoing the most rapid refrigeration, where ice is forming, and consequently the heat of the condensation is most freely liberated from the lower atmospheric strata. The heat generated by condensation is familiar to all who reflect on their sensations when a shower is being formed in the clouds by this process on a sultry day. Were it not for the comparative dryness of the air in the interior of the continent, or rather, if it were moist enough at this season, the cooling of the earth would produce clouds and rain, instead of "dry fog," as Indian summer is technically called.

The phenomenon in question has, it would appear, been more the theme of poets than of physicists. But of minor importance in a meteorological point of view as it may seem, its further investigation might furnish a clue to some problems of our climate which are yet unsolved. The fine particles of dust which often fall on vessels in the open Atlantic, near the Cape Verde islands, when subjected to the microscope, have proved tallies on the winds, serving to fix the direction of the "trade winds" from the African coast, and thus clear up one of the greatest questions of ocean meteorology. Many not less striking examples of seemingly unimportant phenomena leading to important discoveries abound in the history of science.

We may, therefore, apart from the consideration of general interest, hope that the Signal Service will be able to give some attention to this beautiful feature of our autumnal weather. If the explanation of the phenomenon above given holds good, and "Indian summer" is consequently an expression or indication of the cold-determining forces of terrestrial radiation going on within the polar circle on the eve of winter, it would seem not irrational to inquire, might not full "Indian summer" observations in the fall of the year furnish meteorologists with one valuable clew toward forecasting the character of the coming season? Such a result realized would doubly repay all the labor and cost of the necessary research.—*Philadelphia Ledger.*

DIRECTIONS FOR SETTING UP THE RAIN GAUGE AND MAKING OBSERVATIONS.

PROF. F. E. NIPHER, ST. LOUIS, MO.

It is important that the gauge should be placed at the ground, as stated in items 1, 2 and 3 of the printed directions. Trees around a gauge are *an advantage* if they are not too near, (see item 3,) as they keep the wind from striking the gauge. The gauge should be put where *snow does not drift in winter.*

Rain should be measured as soon after fall as convenient (to avoid evaporation), and *at noon if it is then raining*—the afternoon being credited to the next day. (See item 6.) These entries—the time of beginning and ending of rains, *and amount*, should be entered in the wide column of phenomena (or the back, if necessary), under their *true civil date*, the sum for the day being put in the rain column, as stated, thus:

DATE.		AM'T.	K. S.
26	.²5a—6a=1.00 .10—12a=0.25 .12a—3p=0.30	1.25	.
27	*9a—10a=1 inch snow =0.12 water	0.42	* .

Such a record will enable us to *identify* each rain, and will enable us to study its march over the State. We can thus determine where it travels most rapidly, and where it develops greatest violence. This work requires very little time, as it is not raining all the time, and its importance can hardly be over-estimated.

We are glad to have observers do all they can, but it is best not to undertake a greater variety of work than can be done *regularly* and *well*. We hope that no one will slight the rain determination.

Correspondents should write requests for blanks, etc., on a separate piece of paper, as when written on the blank, such notes are more likely to be forgotten. It should also be remembered that our correspondence is very burdensome. In case a letter is not answered, please remind by postal.

CORRESPONDENCE.

SCIENCE LETTER FROM FRANCE.

PARIS, October 15, 1879.

French doctors do not believe in the plague, and view the outbreak of the Astrakan malady as only a normal state of things, intensified by the consequences of war and its partner—distress. The march of the plague is frequently confounded with that of the cholera, while the spread of both is radically different. The plague is sedentary, has a predilection for certain regions, with no inclination, happily, to emigrate rapidly or far. Dr. Tholozan, physician to the Shah of Persia, almost predicted the "endemic," which, he wrote in 1877, prefers, like typhus or scurvy, its favorable *milieu* that war creates. The truth is that the plague has taken ten years to travel from Mesopotamia, Persia and Armenia, to Astrakan. Three years were required for its crossing from the south to the north of the Caspian Sea, though having every facility from land and sea traffic. It is right to note also, that, as usual, doctors differ as to whether it is the plague or a galloping

fever. In the mean time patients die, and the physicians even, succumb. The diagnosis of the disease coincides largely with the symptoms of the black fever which devastated Europe in the fourteenth century. The Russian doctors are not unanimous as to the manner of propagation of the plague. The contagion may be communicated by contact, or atmospheric germs. Now, in 1771 at Moscow, a great number of prisoners were coated with the blood of the plague-stricken and dressed in their infected clothes. Many of the subjects escaped death. However, it is generally believed that the dejections are the principal source of contagion in the case of plague as in that of cholera. Constitutions debilitated by misery, are the first prey for the scourge. The young fall victims more rapidly than the aged, women than men, corpulent than slender persons. Warm and humid climates are very favorable to the malady, and it is checked by excessive heat or excessive cold—but not always. In Nubia, where the climate is very hot Egyptian plagues are unknown. The plague is not peculiar as to a local residence. It is as much at home on dry lands as in deltas and marshes, as virulent in mountainous districts as in plains Prudence, cleanliness and regular habits are the preventives prescribed.

In India there is a class of "spring finders," who pretend by placing their ear to the soil, to hear water oozing underneath. Stretched on their stomachs and listening with profound attention, they claim to hear the water murmuring. This acute sense of hearing is on a par with certain peasants who claim to discover springs with a divining switch, which bends in their hands when they come to a "strike." Their success is to be attributed simply to their knowledge of the region, and the declivity and position of the soil, as certain to have a subterranean supply of water, In volcanic regions many individuals can hear, more or less distinctly, rumblings in the soil. A gigantic trumpet placed against the side of a mountain at Bagrieres de Bigorre, enabled a gentleman to hear a succession of creakings inside the mountain. It was only natural that the microphone, which registers so strangely the most feeble sounds, that the step of a fly equals, relatively, the tramp of a horse at full gallop, has been effectively employed by M. de Rossi, a "volcanist," in his observatory at Rome. He has also the Seismic clocks, that automatcially register at each hour of the day and night, the intensity and direction of the earth's oscillations. By the side of these clocks is the microphone, connected as deeply with the soil as possible. M. de Rossi cannot foretell a catastrophe, but is able to detect three distinct kinds of noises, coinciding with the three special agitations proclaimed by the clocks. The explosions invariably precede the shocks.

Another curious phenomenon of sound is the singing book, now a philosophical toy. Thanks to M. Pollard, naval engineer of Cherbourg, it is within every intelligent person's reach. You place a small book on a table, the floor, or a chimney piece, and presently it distinctly emits songs, sacred and profane, or duets by a piano or harp, and violin solos. The book is composed of ordinary paper,

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leaves of the latter alternating with some of tin. The metal leaves are united, the last two with an electric current, thus forming a condenser. The top and bottom sides of the volume communicate with an electric wire running along the wall but concealed, and terminating in a pile in another room, where the speaker or singer &c., "deposits" the sounds of his voice in a wooden mouthpiece containing a metal plate and a stylus, which, touching a spring, sets free the electric current and transmits the sound to the book, where it is repeated—a phenomenon not yet capable of being satisfactorily explained.

Since twenty years ago the question of school furniture has assumed great and deserved importance—discussion, however, being chiefly limited to the form of the desk, the seat, and above all, the distance to be observed by the pupil between these two. The procrustean rule of having uniform desks and seats for scholars aged seven and fourteen years respectively, is unanimously condemned. Posture is a grave affair, for just as the twig is bent, the tree 's inclined. Either when reading or writing, the pupil ought to observe, like the soldier under arms, an attitude at once defined and calculated. Authoritative doctors state that much of the increasing short-sightedness in the human family is due to a vicious posture of youth when at school. M. de Bagnaux, in a conference on school fittings, recommends five models of seats and desks. The thighs of the pupil ought to rest on the full width of the seat, the legs to hang down straight, the soles of the feet resting well on the floor. The back of the seat ought not to be higher than the haunches, the desk naturally inclined and sufficiently near to the pupil so that the latter's body, without touching either the back of the seat or the desk, would be compelled to maintain the upright position. It is this "distance"—which ought to be as narrow as possible—that constitutes the grandest pedagogic disputes. M. Carnot's desk is in much request. It is constructed after a series of mean measurements of pupils, and to enable the occupant to easily stand up and also to regain his seat. When the pupil desires to rise, he pushes the desk on the slide before him, and draws it to him on sitting down. These hints ought to be noted for children who receive their early education at home.

It is well known that the inferiority of French cavalry horses is owing to their being underfed; it is now asserted that despite the augmentation of 1¾ ounces of meat to the daily ration of the French army, the soldiers are only a little less badly fed. The cause is attributed to the inferiority of the cattle purchased by the army contractors, who have to pick up all the lean and diseased kind wherever obtainable, to secure themselves a margin of profit. Meat is dear in France for two reasons—the large consumption of veal, and of stock killed before being fattened. It is proposed to supersede army butchers, and leave to caporals the right to purchase for their respective companies the meat wherever they find it best. There is a prejudice against the flesh of bulls and cows; this is mistaken, as when in a good state it is equal to that of oxen. All beef is good when it is fat—the sole test for goodness. Many persons in Paris prefer to pur-

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chase the coarse parts of a fat animal rather than the choicest portions of a lean one; just as household bread is richer in gluten than the whitest loaves, where starch predominates. Siegert and Chemnitz have demonstrated that a fat ox contains in its flesh 39 per cent. of water, while a lean animal has as much as 60; hence, so long as soldiers are supplied with poor meat their extra allowances represent only an increase of water and bones.

Father Secchi's work on "The Stars," continues to be not only much read, but discussed. His labors with the spectroscope have enabled us to have clearer ideas about nebulæ, many of which do not contain solid stars, and are not so far from us as is popularly imagined. The "milky way" is a nebula, but of which our sun and its planets make a part, remaining on the outside of the ring, or coiled serpent-folds. Other nebulæ are beyond this one, including masses of stars of a similar order, and whose light takes 10,000 years to reach us, though travelling at the rate of 164,000 miles a second. Pére Secchi makes the ingenious suggestion that the imponderable matter we call ether, and by whose vibrations, under the form of light, we obtain notions of other worlds, is itself limited Thus there would be sidereal worlds, formed like ours, of nebular masses, existing beyond our ken, whose light can never reach us, being separated by spaces without ether, where absolute vacuum reigns, and plunged for our perception in the eternal unknown. Other universes, forever impenetrable to eyes and instruments! What an original and grandiose conception! Nor does the famous Italian astronomer consider these worlds to be silent and deserted; as life fills the universe it can also there exist, provided the temperature be not excessive; life, analogous but not identical with ours; life, associated with intelligence, even of a higher order than ours, for creation is graduated, and man may, after all, be one of the infinite degrees in the scale.

Professor Charcot has unexpectedly brought us back to the days of animal magnetism. He has effected some curious experiments on hystero-epileptic patients in the Salpētrière hospital, producing catalepsy and somnabulism at will. The subject placed for a few seconds, or three minutes, before the full blaze of a drummond, or an electric light, becomes fascinated, the anesthetic state is complete, for he can be pinched, &c., without exhibiting pain. The members display no rigidity, and conserve whatever attitude is given to them. The patient has become cataleptic. In vain you speak to or question him, but the traits reflect the gesture, place him in a tragic posture, the physiognomy becomes severe, and the eyebrows contract; bring the hands together as in prayer, the visage softens, and the features become supplicating. Cut off the light, the patient drops into a somnambulistic or lethargic state; he falls backward, the eyelids close, and if the skin be now rubbed, the part will contract as if under the influence of electricity; touching thus certain nerves, the muscles of the face contort, and the head itself can be made to turn. Here is the somnambulism; call the patient he will rise up and walk to you; tell him to kneel and he will kneel; to write and he wil

write; to sew and he will, mechanically, like a slave, the eyes being firmly closed. Sometimes the answers given are more intelligible than when the patient is wide awake, so much is the intelligence excited. Blow your breath strongly on his face and the subject instantly awakens, after a slight throat spasm and some froth on the lips, but utterly ignorant of what has occurred. The experiment can be repeated at will. But the magnet, as Dr. Burg has shown in the case of metallic applications, plays an important part during the state of insensibility; the patient loses all sense of color; or, the colors of all objects become gray. Violet first disappears, then green, next blue, and last red. Double up the right arm, and it will rest so; bring the magnet to act on the left arm, in a short time the right one will regain its suppleness, and the left arm take the same contracted form. Music, strong bell ringing, can produce this anasthetic condition as well as the lights referred to; hence, the action of sound is identical with that of light. Steadily looking into the eyes will also produce the lethargic state. But this is treading on Mesmer.

There are many varieties of croup, up to its most dangerous form—according to some diptheria, when the whole body becomes infected with the disease, and death generally ensues. Dr. Teste, a physician of standing, reiterates that he has never failed to cure croups by means of bromium, since he first employed it twelve years ago. The remedy is simple: The one hundredth part of pure bromium, dissolved in distilled water; take every hour, and oftener if necessary, at the commencement of the disease, two or three drops of the solution, in a spoonfull of sugared water.

Vanilla came exclusively from the West Indies and Central America, till Messrs. Tiemann & Harmann discovered it in pine tar. M. Sèrullat now prepares vanilla by treating oaten bran, and subjecting it to a special oxidation; the product is the well-known perfume.

The Paris morgue is to be altered to something like an ice-house, and lighted by electricity; the bodies would thus be conserved longer for identification; also, *post-mortem* examinations are to be held in the amphitheater of the medical university, and in presence of the students and the representatives of justice. [F. C.

THE CLAUDE LORRAINE MIRROR.

WASHINGTON, D. C., Oct, 25, 1879.

EDITOR REVIEW: People of æsthetic tastes, it would seem, should be interested in whatever advances the knowledge and introduction of the beautiful. But oftentimes the beautiful is neglected because of notions of great expense connected with it or want of knowledge of its availability. When available however, it would seem that a genuine spirit of taste and culture would, through a little ingenuity or sacrifice, seek to possess it. Though our available funds for art

purposes be very limited, there are many things in this line which may be enjoyed by adding a triflng expense to a little ingenuity. Persons of genuine taste will show their artistic gifts whether they live in a palace or a hut; and oftentimes there is more pleasure in an inexpensive article made by our own personal efforts, than in some very costly affair purchased at the shops.

Some few years ago while out with an artist friend who was sketching from nature, we fell in with another artist who was on a like mission. He had with him what he termed a "Claude Lorraine Mirror," and allowed us to view nature reflected from it. The effect was most beautiful—the "mirror" lending a charm to the natural scenery far beyond what we had anticipated—rivaling the effect of looking into a clear unruffled sheet or stream of water, reflecting the surrounding beauties of nature.

Often when I have roamed amid the woods and come to a quiet, sheltered nook, where some small, lovely sheet of water was well protected from the winds, leaving its surface as smooth as the finest plate glass, and seen the surrounding objects reflected therein, mingled with the delicate water plants, twigs, stones and pebbles at the bottom, I have wished for some power to transpose such loveliness, or even to give us the power to apply it more universally. It seemed a hopeless wish, at least until I so accidentally fell in with a "Claude Lorraine Mirror." Then I was enchanted to find it within the power of the human mind to reproduce this effect at will; and that the instrument that would accomplish it was indeed most simple.

I judge, however that the "mirrors" are not very common, and that they are not at present within the knowledge and reach of many who would like to possess so simple yet wonderful an instrument. The one I saw was about seven inches square and was made of thick plate glass, slightly convex (as a whole plano-convex), for the purpose probably of improving the *relief* of the picture; the back and edges of the glass being blackened for the purpose of absorbing the light.

A common mirror will reflect, but then, for this purpose it would be too glaring, the light would not be soft and pleasant—subdued—like that reflected from the smooth crystal waters of the secluded vale.

Not being able to obtain one of these mirrors, the idea occurred to me that I might make a very fair substitute. So I procured a piece of heavy plate glass, about eight by ten, and tried an experiment. I blackened one side and the edges with japan varnish, giving it two coats for the purpose of securing a deep black that would absorb the light well; and to protect this and if possible add to its blackness, I pasted over the back some strong suitable paper, letting it cover the edges well. Then to make it a little more ornamental, covered this roughness with a neat, dark colored paper. The success of the home made mirror is complete and much better than could have been expected. The greatest expense was for the small piece of plate glass, which was infinitesimal beside the value of the object attained. These mirrors may be made of any size, and be protected by a case or box if desirable. Still, for carrying about, one eight by ten is full large enough.

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Once having viewed nature reflected from a "Claude Lorraine Mirror," I think few persons of taste would be satisfied until they possessed at least so good a substitute as may be readily made out of a good piece of plate glass, as herein described. A little ingenuity and cunning handiwork will secure a most valuable addition to the private art treasures of the person of taste—one, I think, that may be used most universally and with the utmost satisfaction.

ISAAC P. NOYES.

HYPERIA IN THE NECTOCALYX OF ABYLA PENTAGONA.

EDITOR REVIEW:—Will you put this little bit of information in your next number?

The life of Hyperia and its brood in the barrel shaped body of a dead Doliolum is well known. Such Doliola, with crustacea within, are often taken in pelagic fishing. The larger nectocalyx of a Siphonophore Abyla pentagona may replace the Doliolum. I have frequently captured, in my fishing on the Piedmontese coast, in South France, specimens of such Abylæ with Hyperia and brood within. The upper and smaller nectocalyx of the Abyla was always detached. This nectocalyx, of course, never reached the dimensions of a large Doliolum, but it forms a perfect little house for the crustacean and its young. Only one end of this Abyla house of Hyperia has an opening, which is the natural entrance into the bell cavity.

J. WALTER FEWKES.

Cambridge, Mass., Nov. 12, 1879.

PROCEEDINGS OF SOCIETIES.

THE KANSAS ACADEMY OF SCIENCE—SYNOPSIS OF THE PROCEEDINGS OF THE TWELFTH ANNUAL MEETING.

BY PROFESSOR E. A. POPENOE, SECRETARY.

The members of the Kansas Academy of Science met at Topeka on the 6th of November, and occupied the afternoon of that day and the whole of the day following in the usual profitable manner. A business meeting was held at Dr. Thompson's office in the afternoon, when the customary reports were read and committees appointed for the business of the following day.

The lecture of the evening was delivered in the Senate Chamber, by Prof. B. F. Mudge, the President of the Academy, whose subject was "The Mound Builders of America." The lecture was an epitome of our present knowledge of the habits and peculiarities of that ancient people, as evidenced by the remains of

their work in various parts of the country. The lecturer adverted to recent discoveries of mounds in Central Kansas, a full description of which he reserved for a paper to be presented the following day. The lecture was illustrated by a fine collection of typical implements and ornaments, which were examined with great interest by the audience, at the close of the President's remarks.

The sessions of the second day were devoted to the papers on the programme in the order given in the following synopsis of the proceedings:

Prof. Mudge read a paper on the "Metamorphic Deposits in Woodson County." The speaker's investigation of that formation had been conducted with special reference to finding the truth concerning certain reported discoveries of traces of the precious metals in these rocks Many features interesting from a geological standpoint were noted, but the observations made only served to confirm the belief, hitherto expressed by the speaker, of the extreme improbability of the occurrence of these metals in Kansas. The amethyst was added to the list of Kansas minerals from specimens discovered by Prof. Mudge in the deposits mentioned.

Dr. A. H. Thompson gave an account of a recent exploration of Indian graves near Topeka, exhibiting several crania and numerous ornaments as the results. The graves examined were located about six miles west of the city, on the farm of Mr. Rogers, near the old Baptist Mission, and are supposed to have been made by Indians of the Pottawatomie tribe. They were evidently a portion of what had been an extensive cemetery, situated on the brow of a terrace or on a hillside sloping westward toward a large ravine. The locality was covered by trees and bushes which had evidently grown since the formation of the graves. This would indicate an age of about forty years. A group of four graves was examined. In three were found only the skeletons of the Indians buried; but from the fourth were taken also a number of ornaments, evidently of civilized manufacture, consisting of bracelets, buckles and breastplates, or disks, of silver, and chains of brass, resembling cheap watch chains now sold. The metals were oxidized, and required much scouring before the ornamentation could be made out. The nature of the articles, and other circumstances, were thought to indicate the grave of an Indian woman of importance in the tribe.

The report of the Commission on Botany was made by Prof. J. H. Carruth, who had spent the greater portion of the summer in botanizing through several of the southeastern counties of Kansas. This locality had not been well explored previous to his visit, and the results were very satisfactory. About 120 species new to the Kansas list were discovered, and many important verifications of species hitherto reported but not seen by Prof. Carruth. The total number of species now known to grow spontaneously in the State will exceed 1,300, and constant additions are being made. Among the notable additions the speaker instanced the following: Water shield (*Brasenia peltata*), white water lily (*Nymphæa adorata*), flowering dogwood (*Cornus florida*), yellow honeysuckle (*Lonicera flava*), New York iron-weed (*Vernonia noveboracensis*), officinal lobelia (*Lobelia inflata*), a spe-

cies of blueberry (*Vaccinium vacillans*), cassina tea (*Ilex cassina*), trumpet creeper (*Tecoma radicans*), dwarf hackberry (*Celtis pumita*), swamp oak (*Quercus aquatica*, ?), yellow birch (*Betula nigra*), sweet flag (*Acorus calamus*), and two species of ash tree (*Flaxinus platycarpa* and *F. quadrangulata*).

A paper giving some of the results of the summer's observations in the field of Botany was read by E. A. Popenoe, who called attention to the tendency of certain wild flowers to vary in color from the normal shade to pure white. This tendency was noted in the blue phlox (*P. laphamii*), the blue sage (*Salvia pitcheri*), and some others. It was noticed in most cases that there existed a corresponding variation in the shade of green in the other parts of the plant, the leaves and stem being very much paler in the plants with white flowers. Certain hybrids between wild species of *Verbena* were noticed, new stations for rare plants recorded, and some species not previously known to grow in Kansas reported.

Mr. Joseph Savage described the sink-holes found in the southern portion of Wabaunsee county, where they occupy a district about four miles in circumference on the high prairie. They were described as circular in outline, with sides sloping from the margin to the center, where there was an opening into caves beneath.

Mr. J. R. Mead referred to similar sink-holes as being very abundant in Butler county.

Prof. Mudge described a very remarkable one located in the southwestern portion of the State, about fifteen miles from the Cimmaron salt region. This, he stated, was 200 feet in diameter, about 60 feet in depth, and two-thirds full of water strongly impregnated with salt. The sides were perpendicular, and the cavity was apparently left by the direct vertical subsidence of a mass of earth of the volume and dimensions indicated.

Prof. Mudge also gave a brief description of some caves situated in the southeastern part of Kansas, and recently explored by him. They were found to be of considerable horizontal extent, high and narrow, and abounded in stalactites.

Mr. Savage exhibited the results of an examination of some coal deposits near Independence, Kansas. Among them were some fine specimens of carboniferous plants, a beautifully preserved *Sigillaria* of an undescribed species being especially noteworthy.

Prof. Carruth described the deposits of mineral paint that occur near Fort Scott. This paint is said to exist in thin layers in beds of shale, and occurs in three distinct colors—black, white, and red, or light purple. The red is oily to the touch, and all three colors, when mixed with oil are used for marking cattle.

A paper was read by Hon. F. G. Adams, of Topeka, on the phonetic representation of Indian language, describing the systems or alphabets invented by the Cherokee, Sequoyah, and by Mr. Meeker, a missionary who formerly resided in Johnson county. The alphabet formed by Mr. Meeker was said to be adequate to the perfect phonetic representation of any Indian language, and books were printed in the characters of that alphabet in eleven different dialects.

Mr. J. C. Cooper presented his notes on a recent visit to the Cerillos mines, in the vicinity of Santa Fe, New Mexico, graphically describing the geographical, geological and agricultural features of that country, and the peculiarities of Mexican civilization. He considers the valley of the Rio Grande as a region of vast agricultural importance, when irrigation shall be employed to overcome the present aridity of the soil.

Prof. Carruth read a paper on the "Elementary Sounds of Language." This paper consisted of a minute analysis and classification of the various elementary sounds in the modern languages, and evinced an extended knowledge of the subject on the part of the speaker.

Remarks were made by Mr. F. E. Stimpson on the comparative values of substances used for fuel. He described the manner of using damaged or weedy hay and stubble for fuel as practiced by a miller in Hutchison. A careful comparison of the results obtained by the use of hay as against the use of coal in the mill furnace showed in favor of the former, while the daily expense for hay was $2.50 and the cost of coal for one day's firing was $6. The estimate of the daily cost of hay included the wages of a fireman required to feed the furnace, the engineer doing the work of fireman where coal was used.

The evening session was opened by Prof. Mudge, who read a paper descriptive of recently discovered mounds in Davis and Riley counties. The following abstract is furnished by the writer of the paper:

"Quite recently Major J. W. Powell, when on a visit at Junction City, called the attention of John Davis, Esq., of the Junction City *Tribune*, to several mounds on his farm that appeared to be the work of the Mound Builders. Two weeks ago one was opened and found to contain human bones, pottery in fragments—which were clearly of the quality made by that lost race—with arrow-heads, a pipe and beads. The mound was about 30 feet in diameter and but 3½ feet in height, composed largely of stone of all sizes from one to forty pounds in weight. The rocks, bones and implements were all thrown together in the utmost confusion. The bones were in all parts of the mound, from the bottom to the surface, and had evidently been exposed in some other spot and afterward collected and buried here. This was indicated by the broken condition of the bones and the frequent marks of the teeth of wolves. No important part of a skeleton was whole, but the number of teeth, etc., indicated at least four persons, including a child of fourteen years of age.

"The pottery was in fragments, and also scattered in all parts of the mound. Some of it was thick and coarse, and some portions thin and of good workmanship. While I was present, twenty-five or thirty small pieces were thrown out, which I decided to be from one vessel. A portion of this we fitted together, which indicated a neat ornamented cup which held about a pint and a half.

"The beads were about one hundred in number and of four kinds. Sixty-three, made from the stems of a crinoid fossil quite common in the adjoining limestone, lay as left on a string. Others were made from a shell now found in the

Republican river; others were from the hollow bones of a small bird, and one large one was of limestone and was probably worn singly around the neck. The pipe was made of soft limestone. There were eleven arrow-heads, nine of which were of very nice workmanship and each about an inch in length.

"Other mounds are seen in that vicinity, which I am authorized to open at the expense of the Academy of Science.

"In some dozen places in Riley county fragments of Mound Builder' pottery are found, with stone implements, indicating that temporary villages had existed. Near Stockdale these marks are common. A vessel, holding about five pints, was dug up in Manhattan 1,500 feet away from the river, and nine feet below the surface."

The evening lecture was delivered by Prof. Canfield, of the State University, whose interesting presentation of "The Relations of the State to Higher Education" demanded and received the undivided attention of the large audience to the close.

The following resolution was adopted:

Resolved, That a committee be appointed to investigate all the reported new discoveries of coal in Kansas, to furnish a list of all Kansas coal mines and their localities, the thickness of the vein, the nature of the product and its value as fuel, and report thereon at the next annual meeting.

This committee consists of Messrs. R. J. Brown, G. E. Patrick and F. E. Stimpson.

The officers of the year just closed were unanimously elected for another term, as follows:

President—Professor B. F. Mudge, Manhattan.
Vice Presidents—Professor J. H. Carruth and Joseph Savage, Lawrence.
Treasurer—R. J. Brown, Leavenworth.
Secretary—Professor E. A. Popenoe, Manhattan.
Board of Curators—Professors F. H. Snow, B. F. Mudge, E. A. Popenoe.

CHEMISTRY.

THE KANSAS CITY CANDY FACTORY DISASTER.

BY THE EDITOR.

The circumstances attending the destruction of the candy and cracker factory of J. F. Corle & Son, in this city, on Friday, November 7th, give rise to opposing opinions regarding the origin of the terrible accident which resulted in the total destruction of three large brick buildings (Nos. 202, 204 and 206 Main street), with all the valuable machinery and goods therein, and, what is far worse, the loss of six human lives.

Two of the buildings (Nos 204 and 206), were originally ordinary business houses, twenty feet front by about ninety feet deep, and the other was constructed for a bank; all three stories high and constructed ordinarily well. These buildings were occupied by Messrs. Corle & Son for nearly two years, and had been to some extent reconstructed, though in no respect weakened by alterations, except so far as cutting two doorways through each long partition wall would tend to that end. During the first year there were several tons of heavy machinery, such as spice, coffee and mustard mills, in operation upon the second and third floors of these buildings, whose action jarred the buildings very perceptibly. Some months previous to the accident all of this machinery had been removed to the ground floor, and at the time of its occurrence both the second and third floors were only occupied as work rooms for the employees engaged in making crackers and candy.

In the confectionery room, which occupied the third story, there was a furnace for boiling candy and a number of benches at which the candy makers worked. The process of making certain classes of fancy candies is to mold them as iron founders mold cast iron, and trays of fine starch are used as molding flasks, i. e., the patterns are impressed in the starch and the boiling hot candy poured into them from large ladles, the foreman passing along the benches and pouring it into mold after mold as rapidly as they are emptied of the candy, after it is "set." After each operation of this kind the trays are "struck" or leveled off, and the patterns again impressed in the starch and the other steps repeated, with the necessary result of heating the starch more and more, and thus rendering it lighter and more ready to fly into the air with each "striking." Being utterly unirritating to the air passages, the employees could unsuspectingly breathe this powdered starch long after any other almost equally abundant substance floating in the air of the room would have become intolerable. This highly carbonized material having accumulated to an unusual degree, if a volume of *flame*, such as would arise from the rapid burning of a quantity of sugar overflowing upon the heated furnace, were suddenly communicated to the atmosphere of a closed apartment, so filled with its minute inflammable particles, an explosion must inevitably follow. The force of such an explosion would of course depend upon the quantity of the material burned, the rapidity with which it burns and the degree of resistance offered by the walls of the building to the sudden liberation of the expansive gases formed by the combustive process.

There is no question of the possibility of an explosion under such circumstances, and the occurrence of the terrible disasters in the candy factory of Greenfield & Co., about two years since, and in the flouring mills at Minneapolis in May, 1878, was almost unhesitatingly attributed by all investigators to just such causes as are suggested above.

Professor Peckham, of the University of Minnesota, says, "Professor Peck and myself agreed in the conclusion that the mills (at Minneapolis,) exploded from the ignition of a mixture of wheat dust and air. The testimony only established these convictions, and the experimental and theoretical proof placed them beyond

doubt or question. It appears to me that no other conclusion is possible when the question is discussed upon scientific principles, and that all the talk about 'distilling flour,' 'hydrogen' and 'mystery' is superlative nonsense."

From the testimony before the coroner in the Corle disaster, given below, it is very clear that an explosion occurred in the candy room from the ignition of starch particles filling it, which raised the roof, threw out the front wall, and shattered the partition walls between Nos. 202 and 204, and between Nos, 204 and 206, so that the whole mass of material fell upon the furnaces and was at once set on fire, giving such a start to the conflagration that before the firemen reached the spot everything was enveloped in flames.

W. C. Grimes testified that his place of business is No. 209 Main street, and that when the disaster occurred he was standing on a pile of lumber on the sidewalk directly opposite the buildings numbered 204 and 206, and had a full view of what occurred. He was looking up at the third story windows, saw a bright flash and heard a dull sound as if an explosion had occurred; in fact, felt assured that such was the case. Immediately following this he observed the roof of Nos. 204 and 206 rise up at least two and a half feet at a point over the partition wall. Then the front wall began giving way at the top, and was quickly followed by the crumbling of the entire wall. In his opinion the explosion caused the wall to fall. He had been in the building a number of times. There was no heavy weight upon the upper floors. He did not believe the cutting of the doorways had weakened the partition wall, as it was standing after the front wall fell, and was only crushed by the rafters and timbers from above. He saw the elevator three feet above the third floor when the front wall fell.

Frederick Pfau stated he had been employed in the candy department as foreman, on third floor of No. 204. The falling occurred a little after one o'clock; he had set a kettle of sugar on the fire; first sei sation he felt, was a sizzing sound, a hot explosion, and his face, hair and whiskers were singed. The sugar must have run over, got on fire, then exploded, and burned his face. Then the roof began to come down. In his opinion the explosion was caused by starch. Have been working in big candy factories since 1849. In Greenfield's, New York, there was an explosion similar to that of Friday. Powdered starch will explode. There were two barrels of starch near the kettle and on starch boards; did not have a thousand pounds on the floor. There were about nine people on the third floor.

John Woerner testified that he had had twenty-five year's experience in the manufacture of candy, and was employed in the rear of the third story of No. 204. He had seen a kettle of sugar placed on the fire. Saw the kettle boil over and take fire, after which there was an explosion; the walls began to give way and he made his escape by a rear stairway. He stated that he had often witnessed the explosion of starch, but never with such disastrous results. There were about two barrels of starch on the third floor, in various forms.

Eugene R. Corle, son of the proprietor, employed at the factory, had just arrived from dinner when the disaster occurred. Was on the sidewalk in front of

No. 204, and heard a puff, like an explosion. Everything came at once, and the horses ran away. He considered the building and wall entirely safe. Had got clear across the street when front wall fell; heard roof fall first. The weight on third floors of No. 204 would not exceed a ton. There had been ten tons weight on second and third floor of No. 204. There was very little weight in upper floors of No. 206.

James A. McCleary stated that his firm had done considerable brick work around the building. He considered the walls perfectly safe. He had examined them with a view of erecting a fourth story thereon, and pronounced them sufficiently strong for the purpose. In his opinion an explosion would cause the walls to fall as had been described.

W. H. Barnes, employed as general carpenter about the building, was in the box department, an independent brick structure at the rear, when the disaster occurred. He had done considerable work about the walls and considered them perfectly safe. Had cut the lintels for the new door-ways, after which he was called to attend other duties. The openings had been completed and the mortar laid. He did not hear an explosion and saw no fire for three minutes after the walls fell. Did not consider the walls weakened by the openings. In his opinion, an explosion of starch was the cause of the disaster.

George E. Sartwell, engaged as teamster at the factory, had his team backed up against the sidewalk, and was loading goods into the wagon, from No. 204, when he heard a faint noise in the upper portion of the building, looking up, saw the wall falling, his team started, and he turned his attention to them, getting on the opposite side of the street. There were several crashes. He saw the partition wall of Nos. 204 and 206 standing after the front wall was even with the ground. Could not state what caused the wall to fall.

Edward I. Hogan, a resident of Chicago, had visited the city for the purpose of examining some of the machinery in No. 208; had completed his inspection and was about to proceed to the office, No. 202, to see Mr. Corle, when he heard a crash, and thought something had fallen down the elevator. This was followed by a louder crash, and simultaneously with the falling of the walls flames burst out in all parts of the building.

Thomas S. Reyburn, of the firm of Welch, McCleary & Reyburn, brick contractors, had done considerable brick work about the building, and related the care taken in making alterations, building ovens, roasting furnaces, etc. He considered the builing suitable for the erection of a fourth story. The partition wall was perfectly safe but he did not like the appearance of the front wall.

James R. Wasson, testified that he worked with Corle two and a half years, lately as Superintendent of box department and machinery. Was on the second floor of an independent building at the time of the disaster. He did not think the flaw in the front wall had anything to do with the falling, and described the flaw to consist of a small crack, and pieces of plaster dropped out; considered the partition wall a good one, sound in every particular, The building had not

been weakened by cutting the wall; heard no explosion or falling of walls; attention was attracted by a boy calling, and ran down stairs and put out a bale of excelsior which was on fire; knew nothing else respecting the building.

John H. Haney was employed at the manufactory as carpenter for seven weeks Was working when fire took place, in third story of No. 206. Had wall completed about 11 o'clock this morning. Had been employed two days making changes in the door. There was no talk of any danger in making change. Had observed wall settling previous to cutting door out in the side of wall. Remarked slight settling in front walls of Nos. 204 and 206. Did not create any alarm in his mind. After dinner he resumed work for about thirty minutes. Heard a kind of rumbling noise on third floor. He was then on the first floor. Looked up and remarked, "What's that?" when building began to fall. It would seem third floor fell first, then the second tier of joists fell immediately afterward. He was not positive as to cause of disaster, but knew the third floor fell first. He was of opinion that the cause of the falling was a settling in the front wall, caused by some explosion on third floor, causing the wall to fall out.

Andrew Scanlan, at the time of the disaster, was standing 150 feet away, but in full view of the buildings, and testified that the first sounds heard were as if caused by a runaway team drawing a heavy wagon, and on looking in the direction from whence the noise proceeded, observed the front walls of the building fall after which there was a great cloud of dust. He immediately hurried to the place to render assistence. It was some little time after the building fell that he heard the cry of fire or saw any flames. He heard no explosion, and did not see the roof raise, although having a full view of the building.

Charles J. Hucket, employed as engineer of the stationary engine moving all the machinery, recognized the deceased; he was on the elevator of third floor of 204 when the disaster occurred, about 1:30 heard a rattling of bricks, then falling, but no explosion; was twenty feet away; he believed the falling was caused by the giving away of the centre wall, caused by the weakening of the wall in cutting the opening for a door; was some six feet above the floor in full view of the kettle, but saw no explosion; the excelsior scattered on the floor caught fire; could see the furnace after wall fell, saw the flames but not before; there was a crack in the partition wall between Nos. 204 and 206; the doorway was twelve feet from front wall; while placing timbers when hole was made was apprehensive of danger, but had no fears after work was completed.

It will be seen from an analysis of the testimony that all the witnesses except Scanlan and Huckett attributed the disaster to an explosion, which threw down the walls and spread the fire through the ruins and combustible contents of the buildings. Precisely analogous to this was the case of the Washburn Mill and Elevator at Minneapolis. All observers agreed that at the instant of the explosion the mill was brilliantly lighted from basement to attic, the sound produced was a like dull, heavy blow, not communicated laterally to any great distance,

while, within less than two minutes from the time of the explosion, the elevator, 108 feet high, was wrapped in flames from top to bottom. The report is described by Prof. Peckham as "a noise that sounded as if something as heavy as a barrel of flour had been tipped over on the floor above." Others, nearer, heard, "in addition to this report, a sound which they described as a succession of sharp hisses, resembling the sound of burning gunpowder."

Just such a description is given of the Corle explosion by all of the above witnesses, while Pfau pointedly speaks of the "sizzling" sound,

Several mechanics testify that the walls of these buildings were in good condition; sufficiently so to bear the weight of another story, which Mr. Corle contemplated adding soon. To the suggestion that the walls had been shaken, and the bond of the mortar broken by the jarring of the machinery recently removed, it is answered that when the openings were made in the walls for doorways, the brick-work was found so solid as to require the use of a crow-bar to pierce it, and the bricks came out in blocks or masses of several adhering firmly together. In fact, the circumstances of the case, as well as the testimony of the witnesses, seem to indicate that an explosion was the primary cause of the accident.

Numerous experiments have been made to test the explosiveness of various organic substances, all of which resulted in showing, as I have remarked above, that any finely divided, carbonized material floating thickly in the air may be exploded by sudden ignition by a mass of flame.

Professor Peck, another member of the faculty of the University of Minnesota, instituted a series of experiments with wood dust, starch, powdered sugar, flour of wheat, buckwheat, oats, corn and rye, by which he proved conclusively just what I have stated, using only a gas burner, a few ounces of the powdered material and a pair of bellows. In one experiment he took a box having a capacity of two cubic feet, with the lid fitted to telescope into it, a small hole in one lower corner for the nozzle of the bellows and another in the opposite corner for the gas burner. Placing a little flour in the bottom, and dispersing it in every direction through the box by a blast of the bellows, an explosion was produced, which raised the lid with a heavy man standing upon it, high enough to allow of the escape of the burning gas. By another similar experiment he threw a small box, weighing six pounds, twenty feet into the air, consuming less than an ounce of flour. By another he bursted the box and threw the flames half-way across the stage.

Whether the Corle "horror" was caused by an explosion or not, it is very certain from what has been said here that the dust of such establishments as flouring mills, candy factories, coal mines, saw and planing mills, &c., is a most dangerous element, and that its thorough removal is of the first importance.

Cloth or wood impregnated with certain saline substances will not blaze. Borax, alum, and phosphate of soda or ammonia are recommended as most suitable for this purpose.

ARCHÆOLOGY.

THE AGE OF THE CLIFF DWELLERS.

Among the recent additions to the American Museum of Natural History are many casts of curious "cave houses," or cliff dwellings, discovered by the Hayden Geological Survey. These structures are of such evident antiquity that a new epoch is formed which carries the existence of man in this country to so remote a period that the "Mound Builder," of whom we know comparatively nothing, appears comparatively modern. Only these stony ruins remain to tell the story of a once powerful and semi-cultivated people.

The first discoveries of these houses were made by Mr. A. D. Wilson, of the Hayden survey, and a later special survey was detailed under Mr. W. H. Jackson, who returned with the first authentic reports. According to Mr. Ingersoll, most of the ruins are found around the edge of the desert tract formed by the triangulation of the streams Rio Mancos, La Plata and Rio San Juan. The San Juan and La Plata have a width of bottom land between their banks, but the Rio Mancos runs like a brooklet along its narrow path, shut in by walls thousands of feet high. On the terraces of the more open cañons are multitudes of picturesque ruins; in the bottom lands are the remains of towns. In the wilder cañons the houses are perched upon the face of the chasm. In an encampment 1,000 feet above the valley of the Rio Mancos are single houses in groups of two and three and villages, according to the width of the shelf which they occupy. They are so high that the naked eye can scarcely distinguish them as specks. There is no access to them from above on account of the rocks that project overhead, and no present way of reaching them from below, although doubling paths and footholes in the rocks show where the way was trodden of old by human feet.

The cliffs in some parts are limestone, but most frequently sandstone, with alternating strata of shales and clay. The softer layers are hollowed out, leaving caves, whose solid stone ledges serve as the floors and roofs of the cliff dwellings. A few houses have two stories, and one shows four stories, but generally they are not higher than a man's head. Division walls are built from the rear of the opening and running outward to the front of the cave, which is so neatly walled by masonry of the prevailing stone that the artificial work is scarcely noticeable by a casual observer. Upon the summits of the loftier battlements are placed at irregular intervals round stone towers. The curve of the aboriginal masonry is perfect.

As to the habits of these dwellers we know almost nothing. Near the ruin called Hovenweep Castle (the castle of the deserted valley) no bones or signs of graves have been found; only heaps of ashes are left, mingled with charred wood, which tell the story of cremation, and probably of fire worship. It is assumed

that the present Pueblo Indians are the descendants of these people, from the fact that their huts to-day resemble the ancient cave houses. The absence of implements of warfare, either completed or unfinished, gives rise to the opinion that they were a peaceful race. Near some of the cities thousands of flint arrow heads were found sticking in the cliff—all pointing toward the city—showing that some strong invader had attacked them.

According to Mr. Jackson, the most remarkable remains are those found in New Mexico, and some of the buildings equal any in the United States. if we except the Capitol. One of these (shown in the cast by Hayden), the "The Pueblo del Arroya," has wings 130 feet in length, and the western wall of the court is 268 feet. Facing the center of the court are three stories in height. Another, the "Pueblo Chettro Kettle," is 440 feet long and 250 feet wide, and presents the remains of four stories; the logs forming the second floor extend through the walls a distance of six feet, and probably at one time supported a balcony on the shady side of the house. Mr. Jackson estimates that in the wall running around three sides of the building, 925 feet in length and 40 feet in height, there were more than 2,000,000 pieces of stone for the outer surface of the outer wall alone. This surface multiplied by the stones of the opposite surface, and also by the stones of the interior and transverse lines of masonry, would give a total of 30,000,000 pieces in 315,000 cubic feet of wall. These millions of pieces had to be quarried and put into position; the timbers were brought from a great distance, and, considering the vastness of the work and the amount of labor and time that must have been expended, these buildings may well be compared with the most famous works of what is so wrongly called the old world.

Among the caves of the Rio de Chelley were found some of the most beautifully tinted arrow heads ever discovered; also, numbers of large earthen jars of oval design. In a large three-story house were found many implements of domestic use representing the stone age. Among them were large grindstones and hammers. The walls, says Mr. Ingersoll, were plastered with cement of stucco-like finish. That it was spread on the walls by human hands is evident from the marks of the pores of the skin to be found on the surface. Occasionally the whole imprint of the hand has been left. One woman's slender fingers are thus preserved for the people of the nineteenth century.

As to the date of these erections, but little can be determined at present. The Moqui towns are now in precisely the same state of preservation as they were when described by the invading Spaniards, nearly 400 years ago. Assuming the Moquis to be lineal descendants of the Cliff Dwellers, how vast a time the old canyon castles must have been deserted even when the Moquis have no knowledge of the grand homes of their ancestors! Regarding the age of the Pueblos, they were said by Coronado, at the time of the conquest, to look very old. Castenado records that the inhabitants told him that the Pueblos were older than the memory of 700 years. That these ruins were known to the Spanish invaders we have proof in the journal of Don Antonia de Olermin, written in 1681, where

mention is made that eighty leagues distant from their camp there were *Casas Grandas*. Gallatin speaks of them and ascribes them to the Aztecs.

Perhaps time and more extended research may reopen the history of these people, who have been swept away from their grand cities, leaving nothing but the stony walls of their houses to tell the tale of their pre-Columbian greatness; but this we know, that these and other tokens tell that in reality America is the old world, and that thousands of years ago races flourished here in a high state of barbaric cultivation.—*New York Evening Post.*

SCIENTIFIC MISCELLANY.

IMPORTANCE OF TREE PLANTING.

The following extract is from a lecture by Geo. May Powell, delivered at the Pennsylvania State Fair, held at Fairmount Park, Philadelphia, the present fall:

In respect to tree planting, we take the ground, most emphatically, that as the time and labor and money needed to transplant even a small tree will put one hundred tree seeds in the ground, the slogan of the forest creating campaign opening before the nation is, "Plant tree seed where the trees springing from them are to remain." Transplanting, however, has its place, and is not to be ignored. Recent yellow fever experiences prove the south to have millions of dollars worth of trade interests per week involved in the subject of public health. A family in good health, north or south, east or west, may earn $1000 a year net. Sickness in the same family may cause it to suffer a loss—first of the ability to earn that $1,000; second, of $1,000 in expenses incurred by sickness. Such a family has thus $2,000 a year involved in the health question. By parity of reasoning, the nation has untold millions every year wrapped up in the health budget. A forest leaf has tens of thousands of valves made on purpose to pump in the poisonous carbonic acid gas and other "enemies" in the air, and pump out life giving oxygen The trees are also the chief conservators of those thermal and hygroscopic conditions which determine not only the health of men but of domestic animals, also the health of fruit and grain bearing plants. In any one of these relations, forests and climate is a cash question of startling proportions. The human life and health involved is of course not susceptible of financial gauge. A man cannot tell how much he would give to have a dead darling given back to him again.

All this aside from loss of life or health, the value of which cannot be computed. Much of this would be modified or remedied by planting rows, or double, treble or quadruple rows of trees around farms and along roads. Thus a farmer might have a thousand trees where they would harm nothing. If they were nut and sugar bearing trees they would soon annually net him more than a thousand

sheep, and also add more than the cost to the cash value of the farm simply as a question of beautifying it.

He said, we need laws providing forest engineers and literature—fire proof buildings and protection from forest fires; reduction of taxes for those planting trees, so as to squarely meet proper prescribed rules, as certified by a competent forest engineer. There should be no exemption from taxes for foolish or for bogus tree planting. The Forest Council urges people to pay more attention to planting tree seeds where the trees springing from them are permanently to stand, than to transplanting. By this means the expenditure of a given amount of time and money will plant a hundred times as many trees as by transplanting. Steep hillsides especially need this treatment to preserve streams, and are of little value for other use.—*Kansas Farmer.*

NUTRITIVE VALUE OF FLOUR.

Wheat flour contains four classes of substances: 1, water; 2, mineral matter, such as the phosphates; 3, nitrogenous substances, albumen, gluten, etc., which are all classed together as *albuminods;* 4, starch, dextrin, oil, etc., which are all classed together as *carbohydrates.* With the exception of water, these are all of value as food; the less water a flour contains the more valuable is the flour, because we can get water in a cheaper form than by buying it in flour. The albuminoids are valuable because from them we build up all the soft solids of the body except fat. The Germans very forcibly name this class *blutbauer*—blood-builder. While the albuminoids are especially concerned in building up and repairing the waste of the muscular and nervous tissues, they are the sole agents of nutrition. From hearing so much about the amount of albuminoids in flour, one might conclude that they alone are of value in this food material. If any one should come to such a conclusion, he should be fed on the leanest skim-milk cheese till he comes to his senses, for this "white-oak cheese" contains albuminoids in a very concentrated form. Experiments show that an animal will starve on pure albumen or fibrin. No animal can live on food entirely deprived of nitrogen, nor can he remain in health on food entirely deprived of carbo-hydrates. The due mixture of these two classes of food is what is needed for a perfect food, and this combination we find in flour, and this is one reason why wheat flour is so generally the food of all civilized men. Dr. Edward Smith has calculated that an adult laborer must consume on the average 214 grains of nitrogen and 4,831 grains of carbon in his daily food. If wheat flour contains 11 per cent. of albuminoids and 76 per cent. of carbohydrates, then 28 ounces of flour would contain almost exactly the quantity of nitrogen and carbon for this labor diet. If the flour contains less than 11 per cent. of albuminoids, we require the addition of some other substance rich in nitrogen, such as flesh, to form a perfect food. Dr. Letheby says: "The best variety of flour for bread is that which contains

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less gluten than the preceding, as from 8 to 10 per cent. of it, instead of from 12 to 14 or 15. Dantzic flour and soft Spanish, as well as the American, called Genesee, are the best examples of it, and are highly esteemed by bakers on account of the fine quality of bread which is procurable from them, the richer varieties of hard glutinous wheat being used only to impart strength to weak and inferior descriptions of flour." It is not solely as a source of combined nitrogen in our food that the albuminoids in flour are desirable. We not only demand the presence of certain elements in our food, but that these materials shall be presented in certain physical conditions in order to secure their palatability and easy digestion. It is not enough, when presenting to a person a heavy sodden bread, to tell him that all the necessary food elements are present. He wants them in a form to gratify his taste, and to insure their rapid and easy assimilation in the process of digestion; he wants light bread, instead of a solid brick of baked dough. It is the peculiar relation of these albuminoids to light bread which renders them so important in bread making; and their physical properties are no less important than their chemical properties in any proper estimate of the value of flour.—*Prof. R. C. Kedzie.*

THE ESPIRITU SANTO.

Some time since my attention was called to a rare and beautiful flower in the possession of a popular florist of this city. This flower is known as the Espiritu Santo, or flower of the Holy Spirit. It is indigenous to the Isthmus of Panama, whence this specimen was brought. The flower is rare even in its native land. The stalk, which grows to a length of three and sometimes four feet, is surmounted by the buds and blossoms. The flower, which is not large, is of a delicate creamy white, and exhales a faint sweet perfume. One half of the flower is upright, the other, folded back, exposes a most dainty floral grotto, in which rests, as in a little cup-shaped nest, a tiny dove with outstretched neck and extended wings as if about to fly. The dove is of the same creamy white as the rest of the flower, with the exception of the upper extremities of the wings, which are beautifully speckled. The perfection and life-like appearance of the dove are incredible to persons who have not seen the flower.

In its native land the Espiritu Santo is held in religious veneration, and is supposed by the devout though ignorant natives to be a special emanation of the person in the Trinity whose emblem it bears. It is believed that if the flower be rudely plucked from the parent stem, or trampled under foot, the hand or foot which is the guilty agent of the deed will shortly wither and lose all life and power. If, on the contrary, it be plucked with a prayer, and for a good purpose, the hand that culls it will be shortly filled with treasure that must bring joy to the heart of its owner, being God-given. No wild beast has power to harm the fortunate possessor of a fresh and living blossom of this wonder-working plant, and of course it is equally efficacious in sickness.—J. C. BEARD, in *Harper's Magazine for November.*

SWEDISH SCHOOLS.

Gothenburg, Sweden, has a school system with some excellent and rather novel features. It is compulsory, and is entirely sustained out of the public fund. An end which is never lost sight of is that, when boys and girls are turned out into the world to assume the functions of citizens and to care for themselves, they shall not only have an elementary education, but shall be reasonably well skilled in some bread-earning occupation. Every school has a practice-shop where mechanical instruction is imparted by experienced masterworkmen or mistresses, who are paid like ordinary teachers. Blacksmithing, shoemaking, book-binding, brush-making, carpentering, wood-turning, basket-making and carving are some of the trades which are taught. After being variously tested, a boy is thoroughly trained in the trade for which he has shown the greatest aptitude. In the practice-shops for girls they are instructed in industries suited to their sex. The proceeds of the pupils' work, which is sold, go far toward paying the expenses of the schools. It is inevitable that eventually similar facilities for industrial education must be incorporated with the American school system. We can not expect to escape the same popular necessities for this which have been developed in older countries. Sweden is by no means alone in adopting this expedient to prepare her youth to be immediate producers after leaving school. In Hungary, Germany and Scotland there are notable and well-established systems of this kind. An education is deficient, no matter how brilliant it may be, which does not fit its recipient to forthwith support himself from the hour that he bids farewell to his tutors.—*Globe Democrat.*

THE NEW WORLD POTTERY.

The specimens of American pottery, as they may be studied in such collections as those of the Smithsonian Institution at Washington and the Peabody Museum at Harvard, are divisible into great and easily distinguishable classes. There are, first, the water vessels and domestic utensils, such as jars and pots, which have been exhumed on the coast settlements. There are, secondly, the vases, many of which are decorated with human faces in relief, which come from Cuzco and Lake Titicata. A third division might be formed of vessels modeled after the human head, in some of which are preserved wonderfully fine types of the heads and faces that attracted the potter. Upon the first of these classes, the water vessels of the Chimus and inhabitants of the towns upon the coast, the greatest amount of ingenuity seems to have been lavished. They supply a comprehensive and curious index to Peruvian customs. The typical shape is a rotund jar with an arching hollow handle, and spout projecting upward from the middle of the arch. The handle and spout are of identically the same pattern in many cases where the body of the vessels is never seen twice alike. In devising the shape of the latter, the Peruvians followed a rule which is discovered in opera-

tion in every country with any claim to the possession of an original art. They found models in nature, and in the appliances and usages of their every day life. One of their jars thus represents a musician; another, a primitive boat; and where the double body is brought into requisition, or where a short neck takes the place of the syphon handle, a hundred instances are supplied of an appeal for suggestions to the familiar surroundings of the potter. Thus, in one case, the two sections of the body consist of a stag and a doe; in another, the orifice of one of twin bottles is occupied by a bird; in a third, one compartment is modeled after the human figure; in a fourth, the jar is single, and represents the human head and bust, the orifice being in the top of the head. A like rule was followed in designs graved in the paste, one being a rude and inartistic semblance of the human face, and another consisting of a bird. There are also painted representations of birds, serpents and double-headed snakes, and these are found mingled with geometrical designs, such as diamonds arranged in vertical bands and other patterns, which recall the early efforts of the Greeks, before their emancipation from Phœnician and Assyrian influences. The art of Peru, broadly speaking, may be said to have sought expression in three distinct forms, which are met with in the ceramic art of every country that passed the most primitive stage, namely, the imitation of natural objects by the modeler, who follows the actual form, and the same imitation by means of graved outlines and colored representations —*November Atlantic.*

IMPROVED TANNING PROCESS.

Dr. Chr. Heinzerling, of Frankfurt, a. M., Germany, has invented and patented a new and improved tanning process, which produces better and more durable leather, and is from twenty to twenty-five per cent less expensive than the old methods. The greatest advantage that it possesses over the old methods is that it requires but three to five days instead of as many months.

The raw hides are unhaired and swelled in the ordinary manner, and are then placed in a solution of sour bichromate of potassa, or sour chromate of soda, or sour chromate of magnesia and alum, or sulphate of alumina and salt. They remain in this solution for a few days, according to the thickness and quality of the hides and the concentration of the solution.

Instead of placing the hides directly in one of the above solutions, they can be first submitted to the action of a solution containing about ten per cent of alum and some small pieces of zinc. By the action of the alum and the zinc, amorphous alumina (clay) is deposited upon the fibers of the hide, and prevents an injurious action of the strong solutions. If the hides have been in the above solutions of soda or alum for a certain time, a few per cent of ferrocyanide or ferricyanide of potassa are added, which will prove to be very effective for the leather to be used for the uppers of shoes.

They are then placed in a solution of chloride of barium or acetate of lead,

or soap, for a few days, to fix the tanning substances. They are then dried and treated in the ordinary manner with fat, or paraffine, or naphtha, dissolved in benzine and similar substances, to which a small quantity of thymol or carbolic acid should be added.—*Deutsche Industrie Zeitung.*

THE ORIGIN OF WHEAT IN AMERICA.

Some time ago we published in these columns the commonly received statements in regard to the introduction of wheat into America from Europe, but if the fact stated below be true, then wheat must have grown in America long before the advent of the Spanish, English or Dutch to this country, or even of the Norsemen. It is generally supposed that Cortez planted in Mexico, in 1530, the first wheat ever grown on American soil. From Mexico wheat was introduced into Peru. The English and Dutch brought it to the present limits of the United States at the time of their first settlements here—1607, 1614 and 1620. Now, however, the story is brought forward that wheat was known to the Mound Builders, who inhabited this country heaven only knows how many centuries ago, but certainly no later than the year 1000 A D. As our readers are aware, these aborigines have left traces of their occupation all over our country, especially in the Mississippi Valley.

In a mound opened in Utah, were found buried the remains of a man six and a half feet in length, the skeleton of a woman nearly as long, and, moreover, handfuls of wheat preserved in a stone box. If this discovery was really made, and we are assured that it was, the supposition that wheat was unknown in America before the coming of Europeans is erroneous. It has commonly been supposed that the only cereal known to the Mound Builders was our maize or Indian corn.—*American Miller.*

WHY WE BUTTER OUR BREAD.

The layers of the wheat berry, as we proceed toward its center, become more and more completely starchy, and at the center but little else is found, and this portion makes our finest flour. The finer the flour, the less fit it is for nutrition. In its natural state, the wheat, with all its componets present, is not fully fitted for perfect human development There is deficiency in the potential heat producing materials, especially for cooler climates, there being only two per cent of fat in wheat. We instinctively supply this deficiency by the addition of fatty bodies. We spread butter upon bread, we mingle lard or butter with our biscuit or cake, and the fat meat and bread are taken alternately or coincidentally. The starch being a carbonhydrate, can afford, comparatively, but little heat in consumption, and the fats are demanded by the wants of the system.

Malleable bronze is made by alloying thirty-eight parts of copper with twenty-five parts of zinc, the copper being loosely covered with the zinc in the crucible. When the zinc has been fully incorporated with the copper, the alloy is cast in molding sand in the shape of bars, which are said to be capable of being hammered into any shape when hot.

Nonnus, the Egyptian, thus sang of the contrasts presented by the fertile fields and crowded port of Tyre:

"The ploughman draws his furrow
Beside the sounding shore;
The sailor's galley leaves behind
The foam of many an oar;
The Dryads of the mountain range,
Where the tall cedar waves,
Hear the Nereids, calling sweet,
Rising from ocean caves;
And the cool wind from Lebanon
Fans the tired laborer's brow,
Then swells the purple sails above
The trireme's rushing prow."

Others in ancient song compared her white walls and symmetrical towers to "a virgin bathing in the sea," "a galley of Tartessus swimming in mid-ocean," while a third described her as "an island on shore, and a city in the sea."

Mr. Peter Cooper, of New York City, has recently patented an improvement in the propulsion of railway cars, which consists in a combination of the well-known mechanical powers by which trains of cars can be propelled at any desired speed by means of an endless chain or wire rope.

Paper is now substituted for wood in Germany in the manufacture of lead-pencils. It is steeped in an adhesive liquid, and rolled round the core of lead to the required thickness. After drying, it is colored, and resembles an ordinary cedar pencil. The pencils sell in London to retailers at about 65 cents a gross.

BOOK NOTICES.

THE LIBRARY ATLAS. Imperial octavo; one hundred maps. Geo. P. Putnam's Sons; 1879; $10.

This work, which is the most complete and comprehensive we have ever seen of the kind, is an innovation upon the traditional, cumbrous old folio, as inconvenient as the Englishman's turkey, which was a "a bird too big for one man and

not enough for two." In this we have an octavo volume that one can hold in his hands or lay on his table without removing everything else, and can even put it away in his book-case with his other books, an unheard of luxury in atlases hitherto. Aside from this advantage, which is no small one, it is an admirable piece of work in every way—engraving, printing, mounting and binding. Every workman who has touched it seems to have been an artist in his line and to have done his best work on this book.

But, good as the mechanical work is, it has been fully equaled by that of Doctors Boyce, Collier and Schmitz, in their respective treatises on Modern Geography, Historical Geography, and Classical Geography, which make up the first two hundred pages of the book and are devoted to careful and accurate descriptions of the countries of the world from each author's standpoint.

The maps are perfection itself in their details, and number one hundred and two, including two charts of the planetary system, mostly double paged, and illustrative of the texts as classified above, and modified to keep abreast of the latest discoveries in both arctic and equatorial regions.

For a library, whether private or public, and as a book of reference on all geographical subjects, it may be regarded as a *sine qua non*.

THE NATURAL HISTORY OF THE ANCIENTS. By Rev. W. Houghton, M. A. Crown octavo, pp. 240. Cassel, Petter, Galpin & Co., New York; 1879; $1.75.

In these "Gleanings" the author has gone into the fields of ancient Egypt, Assyria, Palestine, Greece and Rome, beginning with the dawn of history and coming down to the time of Christ and the Apostles. He has worked with untiring industry among all ordinary and extraordinary sources for the information he imparts, and has succeeded in bringing together hosts of facts on natural history from widely diverse sources, which make up a most interesting and attractive book. It is a "new departure" in the literature of the day, and will doubtless meet with abundant success.

CHATTERBOX. Edited by J. Erskine Clarke, A. M. Royal octavo, pp. 420. Estes & Lauriat, Boston. For sale by M. H. Dickinson; $1.25.

The children must be amused and instructed as well as grown folks, and if there is one book in these days of beautiful juvenile publications that will suit a six-year-old better than another, it is "Chatterbox," with its vivacious, instructive and harmless stories and copious collection of fine pictures. We do not see why the children don't "cry for it" until they get it; but they won't cry afterward—for awhile, at all events.

EDITORIAL NOTES.

THE first lecture of the extra winter course before the Kansas City Academy of Science was delivered on the evening of November 13, to a full house, by Prof. F. H. Snow, of the Kansas University. His subject was Meteors, which was treated in a most interesting and comprehensive manner. The Academy is indebted to Prof. Snow for opening the course in a highly satisfactory manner; almost, in fact, insuring its success.

Prof. G. C. Swallow. of the Missouri State University, will deliver the second lecture of the course, on the evening of December 16, at Rev. C. C. Kimball's church, on Wyandotte street, near Ninth; subject, "Creation and Evolution." Season tickets for the course may be had from any member of the academy for $1.25. The remainder of the course is as follows:

December 16, Prof. G. C. Swallow, University of Missouri—Creation and Evolution.

January 13, Prof. J. T. Lovewell, Washburn College—Subterranean Drainage.

February 17, Prof. F. E. Nipher, Washington University—Choice and Chance.

March 16, Prof. B. F. Mudge, Yale College—The Drift Period.

April 13, Prest. S. S. Laws, University of Missouri—Subject to be announced.

May 19, Rev. Dr. Richard Cordley, Emporia, Kansas—Patience in Culture and Investigation.

The Academy has also secured Prof. R. A. Proctor, F.R.S., the celebrated English astronomer, for one or more lectures in the month of March, 1880. Date and price of tickets will be announced in due time.

THE wind storm of November 14 seems to have been quite extensive through the States of Illinois, Ohio, Indiana and Kentucky, amounting in some instances to a regular tornado. Troy, Hamilton, Marietta, Zanesville, and other points in Ohio; Cairo and other places in southern Illinois; South Bend, Paoli, Richmond and Hagerstown, Indiana, and Louisville and Paducah, Kentucky, were visited and much damage done.

A NEWLY invented locomotive in England is expected to at once supersede the employment of horses upon street railways in that country. It has been thoroughly tested and emits neither smoke nor steam. Its speed is from six to seven miles an hour, and its motion is practically noiseless. Thus it fulfills every condition which can be reasonably required by the public for a street engine.

THE pamphlet on The Quantrell Raid upon Lawrence, by Mr. John C. Shea, of the *Evening Mail*, will be read with renewed interest by those of our readers who had personal knowledge of it at the time, and with horror and amazement by those who were living at a distance and knew nothing of the intense malignity and fierce vindictiveness of the Border warfare of 1861 to 1865. It is carefully and truthfully written, and is well worthy of preservation as a typical chapter of the history of those bloody times.

DR. A. H. THOMPSON, of Topeka, Kansas, writes very pleasantly as follows: "We in Kansas feel a great interest in the REVIEW, and rather claim a share in the proprietorship, not being willing to consider it altogether a Missouri growth. We like it very much and wish it every success."

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